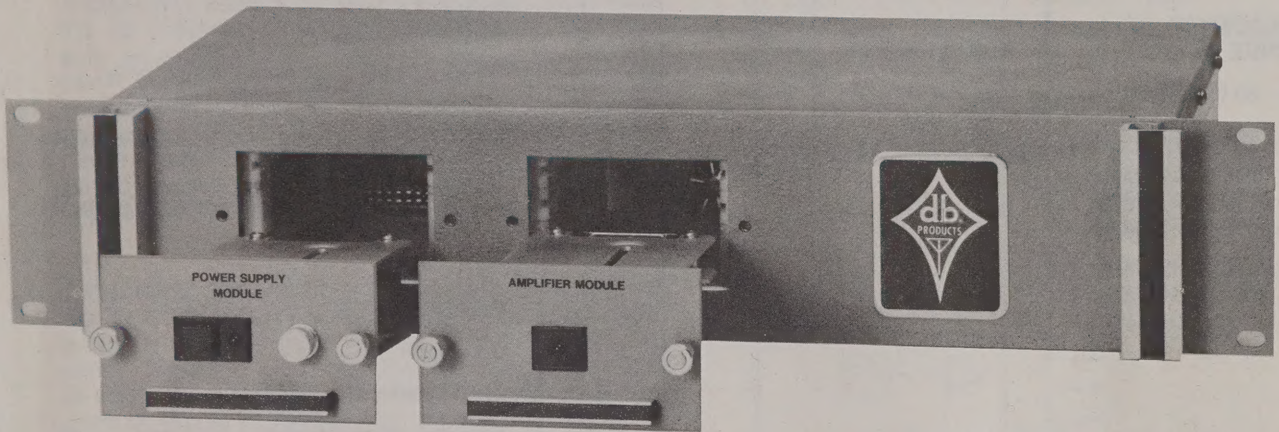
30 - 845 MHz

4 TO 32 CHANNEL MODULAR RECEIVER MULTICOUPLER



MODELS: DB-8104-101 thru **DB-8532-302**

- **Modular**
- **Versatile — Field expandable**
- **Number of options, accessories and configurations to choose from.**

MODELS DB-8100 through **DB-8500 series** Receiver Multicouplers incorporate modular construction with the latest in R. F. design technology. These receiver multicoupler packages are available for the 30-88MHz, 148-174MHz, 406-512MHz, and the 806-845MHz bands. Featured are the modular power supplies, modular R. F. amplifiers, and the low profile chassis (3.5" x 19" x 10") that will provide for up to 32 channels.

APPLICATION. The Receiver Multicoupler packages provide (19" Rack Mount) for receiver combining. Narrow or broad band response is accomplished by selection of appropriate filtering. Insertion loss due to the power splitters is offset by the gain of an R. F. amplifier. There are three receiver multicoupler configurations available (see Fig. 1). Field expansion is easily made by amplifier change if needed and the addition of power splitters. These items are listed under accessories.

MULTICOUPLER AMPLIFIER ISOLATION is provided by the use of a helical preselector or Shape Factored Filter® (window filter). The D.C. ground provided by either filter protects the R.F. amplifier from possible lightning or static discharge damage.

INTERFERENCE PROTECTION is best provided by the use of a Shape Factored Filter® preselector (window filter). The helical preselector option provides minimum selectivity similar to that provided by a typical helical resonator found in the front end of a receiver.

800MHz: In the 806-845MHz band, the R. F. amplifier provides a 3.5dB noise figure and a receiver multicoupler 4 to 16 channel system gain of 4dB(min.) This will provide an optimization of the Sinad response of the receiver. In this band, with the external noise levels being so low, better Sinad response means higher individual receiver performance.

RECEIVER MULTICOUPLER MODEL NOMENCLATURE

Ordering or identifying the receiver multicoupler is straight forward with the 7 digit model-nomenclature number. A digit or digits within the model-nomenclature number identifies the frequency range, number of channels (receiver output ports), power input requirements (ie, 115VAC, 11-15VDC, 220VAC), helical preselector option, and receiver multicoupler configuration.

DB-8 ( )( )( ) - ( )( )( )

FREQUENCY RANGE

1 - 30 to 88MHz

2 - 148 to 174MHz

3 - 406 to 420MHz
450 to 482MHz
482 to 512MHz

5 - 806 to 821MHz
825 to 845MHz

REQUIRED CHANNELS

04 - 4 Channels

08 - 8 Channels

12 - 12 Channels

16 - 16 Channels

24 - 24 Channels

32 - 32 Channels

RECEIVER MULTICOUPLER CONFIGURATION

0 - 4 Channel non-expandable only
8 Channel non-expandable only

1 - 4 to 16 Channel expandable in 4 channel steps.

2 - 8 to 32 Channel expandable in 8 channel steps.

FILTER OPTION

0 - None

1 - Preselector (Helical)

Provides attenuation of out of band signals and D C isolation between the multicoupler amplifier and the antenna.

POWER SUPPLY

1 - 115 VAC Supply

2 - Delete 115VAC Input Power Supply. Add 11-15VDC input option

3 - 220 VAC Supply

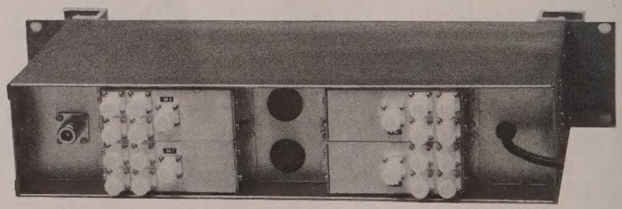
EXAMPLE

DB-8312-111 This model number would indicate a 12 channel, 406 to 512MHz receiver multicoupler with 115VAC power input requirement and helical preselector.

Decibel's modular receiver multicouplers are designed to provide up to 32 channels yet occupy only 3½ inches of 19" rack space. This is accomplished by use of a specially made four way or eight way power splitter which mounts on the back panel of the multicoupler chassis.

These power splitters use BNC female connectors to obtain this sleek package design. RG-142 cable with BNC male connectors is recommended between the receivers and receiver multicoupler.

The antenna input to the receiver multicoupler is N-type female.



REAR VIEW

RECEIVER MULTICOUPLER CONFIGURATIONS

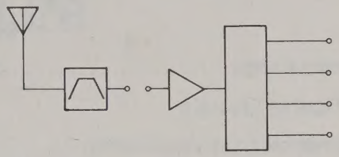
There are three receiver multicoupler configurations available. All three yield maximum versatility, economy, and performance.

4 and 8 CHANNEL NON-EXPANDABLE configurations utilize a low gain amplifier and a single power splitter (4-way or 8-way).

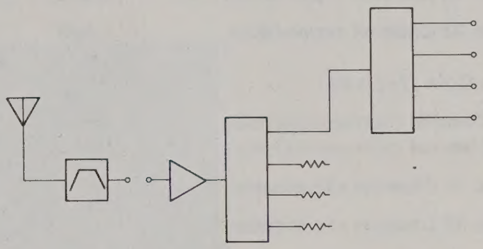
4 CHANNEL EXPANDABLE (in 4 CHANNEL STEPS UP TO 16 CHANNELS) configurations utilize a medium gain amplifier with its output connected to a 4 way power splitter internally mounted. One to four power splitters (4-way) are mounted on the back chassis panel and interconnected to the internally mounted 4-way power splitter. This interconnect configuration guarantees the same multicoupler performance to each receiver connected; be it 2, 4, 8, 12, or 16.

8 CHANNEL EXPANDABLE (IN 8 CHANNEL STEPS UP TO 32 CHANNELS) configurations utilize a high gain amplifier with its output connected to a 4-way power splitter internally mounted. One to four power splitters (8-way) are mounted on the back chassis panel and interconnected to the internally mounted 4-way power splitter. This interconnect configuration guarantees the same multicoupler performance to each receiver connected; 8, 16, 24, or 32.

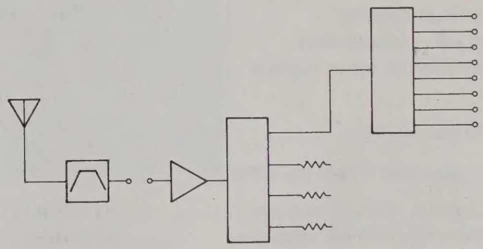
FIGURE 1 - RECEIVER MULTICOUPLER CONFIGURATION BLOCK DIAGRAMS.



4 CHANNEL NON-EXPANDABLE



4 CHANNEL EXPANDABLE (in 4 CHANNEL STEPS UP TO 16 CHANNELS)



8 CHANNEL EXPANDABLE (in 8 CHANNEL STEPS UP TO 32 CHANNELS)

ACCESSORIES

MODEL	DESCRIPTION
DB-8900	Chassis only w/(115VAC) power cord
DB-8918	4 Way 30-512MHz Power Splitter
DB-8919	8 Way 30-512MHz Power Splitter
DB-8920	4 Way 800-870MHz Power Splitter
DB-8931	Helical Preselector VHF
DB-8932	Helical Preselector UHF
DB-8942	400-512MHz Amplifier (low gain)
DB-8944	30-400MHz Amplifier (medium gain)
DB-8945	148-850MHz Amplifier (high gain)
DB-8950	Power Supply (115VAC to 10VDC)
DB-8951	Power Supply (220VAC to 10VDC)
DB-8952	Power Supply (115VAC to 15VDC)
DB-8953	Power Supply (220VAC to 15VDC)
DB-8954	Power Supply (12-15VDC to 10VDC) Regulator
DB-8955	Power Supply (12-15VDC) input polarity and high voltage protection
DB-8922	Power Splitter BNC 50 ohm Loads
DB-8923-8	8 Channel - 19" Rackmount BNC to N-Female Connector Cable Kit/w Panel
DB-8923-12	12 Channel - 19" Rackmount BNC to N-Female Connector Cable Kit/w Panel
DB-8923-16	16 Channel - 19" Rackmount BNC to N-Female Connector Cable Kit/w Panel
DB-8923-24	24 Channel - 19" Rackmount BNC to N-Female Connector Cable Kit/w Panel

ELECTRICAL DATA

	DB-8100 Series	DB-8200 Series	DB-8300 Series	DB-8500 Series
Frequency Range	30 to 88 MHz	148 to 174 MHz①	406 to 512 MHz	806 to 845 MHz
Noise Figure (Typical)				
4 Channel (non-expandable)	4.5dB	5.0dB	5.0dB	②
8 Channel (non-expandable)	4.5dB	5.0dB	5.0dB	②
4 to 16 Channel expandable	4.5dB	5.0dB	5.0dB③	3.5dB
8 to 32 Channel expandable	4.5dB	5.0dB	3.0dB	3.5dB
System Gain (Typical)				
4 Channel (non-expandable)	+2dB⑤	+2dB	+2dB	②
8 Channel (non-expandable)	+3dB⑤	+3dB	+3dB	②
4 to 16 Channel expandable	+3dB⑤	+2dB⑤	+0dB③	+6dB⑤
8 to 32 Channel expandable	+1dB⑤	+0dB⑤⑥	+7dB⑤	+3dB⑤
Rx/Rx Isolation		greater than 20dB		
Helical Preselector (1dB Bandwidth)	600KHz	3 MHz	7 MHz	15 MHz
Receiver Multicoupler absolute I.M. suppression with two -35dBm input signals		greater than -120dBm (Typical amplifier 3rd order intercept point is 34dBm)		
Input/Output VSWR		1.5 to 1 (max.)		
1dB Compression Point (minimum)				
4 Channel (non-expandable)	+17dBm⑤	+17dBm	+17dBm	②
8 Channel (non-expandable)	+17dBm⑤	+17dBm	+17dBm	②
4 to 16 Channel expandable	+20dBm⑤	+20dBm⑤	+17dBm③	+18dBm⑤
8 to 32 Channel expandable	+20dBm⑤	+20dBm⑤	+18dBm⑤	+18dBm⑤

MECHANICAL DATA
(ALL MODELS)

Dimension	
Height	(8.89 cm)3½"
Width	(48.26 cm)19"
Depth	(25.4 cm)10"
Connector terminations (input, output)	N-Female, BNC Female
Finish	Grey Beige Vinyl enamel
Net weight	(4.5 kg) 10 lbs.
Shipping weight	(5.4 kg) 12 lbs.

ORDERING INFORMATION

① 118 to 136 MHz and 225 to 400 MHz are available on special order. Contact the factory for details.

② Not available in this band as a non-expandable model.

③ The 406-512 MHz, 4 to 16 channel models are available with a high performance amplifier providing a 3.0dB noise figure and 6dB multicoupler gain. Amplifier third order intercept point is 34dBm.

④ Specify operating frequency when ordering receiver multicoupler.

⑤ Models using 15VDC amplifiers will have some degradation to specifications when operated with the 11-15VDC input option.

⑥ The 148 to 174 MHz, 8 to 32 channel models are available with a higher gain amplifier providing +9dB system gain.

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SP154 12-79
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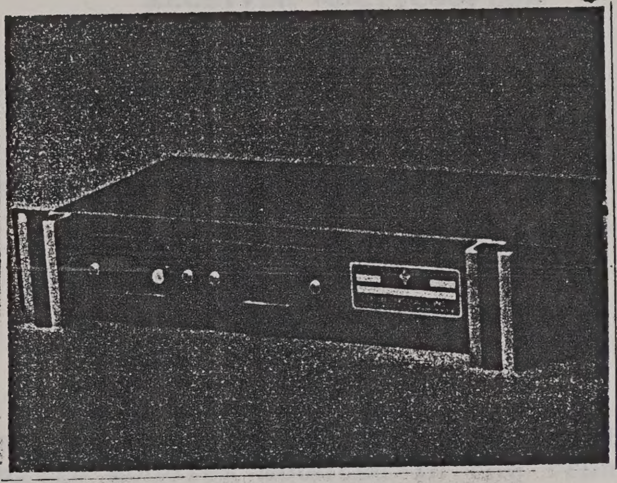
DB-8500 SERIES
RECEIVER MULTICOUPLER



SPECIFICATIONS:

Dimensions (HxWxD)	3½" x 19" x 9½" (8.9 x 48.3 x 24.13 cm)
No. of Receiver Ports	4, 8, & 16 (Expandable to 32)
Isolation between Receiver Ports	20dB
Input Power Required	115VAC, 20ma
Frequency Range	806-870MHz
Noise Figure	3.5dB
Intercept Point	36dBm Typical

DECIBEL PRODUCTS, INC.
A SUBSIDIARY OF COMMUNICATIONS INDUSTRIES, INC.
3184 QUEBEC • 214-631-0310 • DALLAS, TEXAS 75247

DB-8500 SERIES
RECEIVER MULTICOUPLER

I. General Description

The DB-8500 Series Receiver Multicoupler consists of basic components ---

1. Power Supply Module
2. Amplifier Module
3. Power Dividers
4. Chassis

The power supply and broadband amplifier are plug-in modules mounted in the front panel of the chassis for easy service.

The Power Dividers are mounted on the rear of the chassis for ease of accessibility. The chassis is a sleek 3.5 x 19 x 9.5 inches and made to mount in a standard 3.5 by 19" rack space.

The power supply is either 115 or 220 vac. (DC option is available.)

II. Amplifier

The purpose of amplifier is to provide enough power gain to compensate for the losses in the BPF and the power divider. Thus, each receiver connected to the multicoupler is presented with the same imput signal level as is supplied by the antenna.

Listed below are the important amplifier Specifications:

Frequency Range.............806-850 MHz

Gain.......................Approx. 23 dB

Noise Figure................3.5dB

1 dB Compression Point......+18 dBm min.

Third-Order Intermod

Intercept Point.............+36dBm Typical

Current drain @ +15 vdc.....125 ma

III. Power Divider

The power divider is a broadband, lumped constant device consisting of ferrite transformers and baluns. It's purpose is to divide a single signal into several equal level signals while simultaneously isolating the output ports from one another.

SPECIFICATIONS:

Frequency range..................806-850 MHz

Insertion loss

(Including power split)..........8.0dB

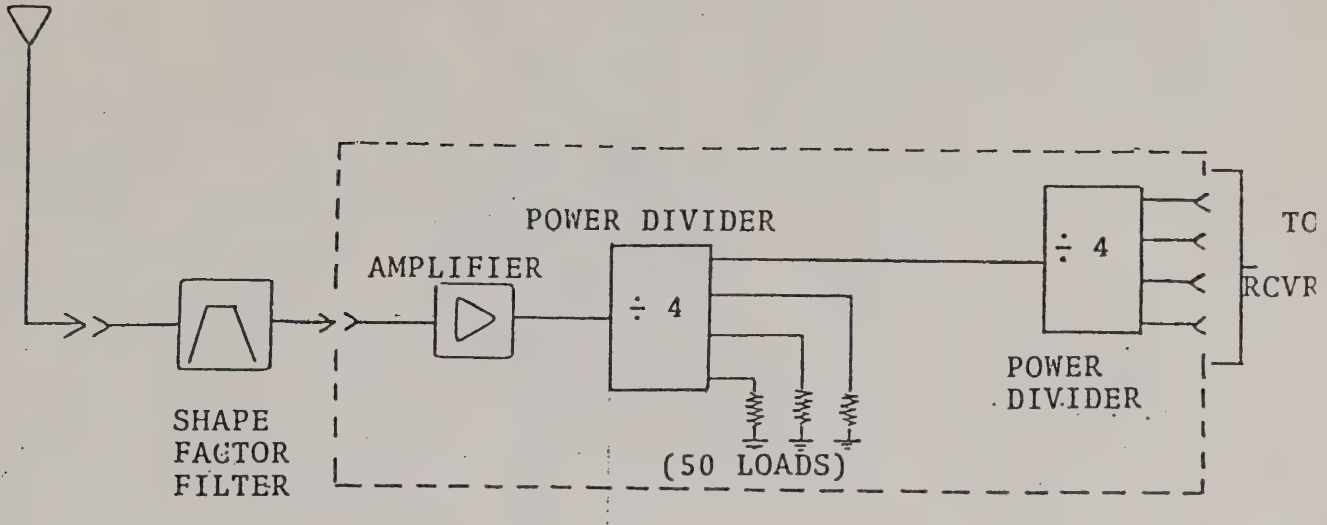
Isolation, output to output......>20dB

Output VSWR (wrt 50 ohms)........1.5:1

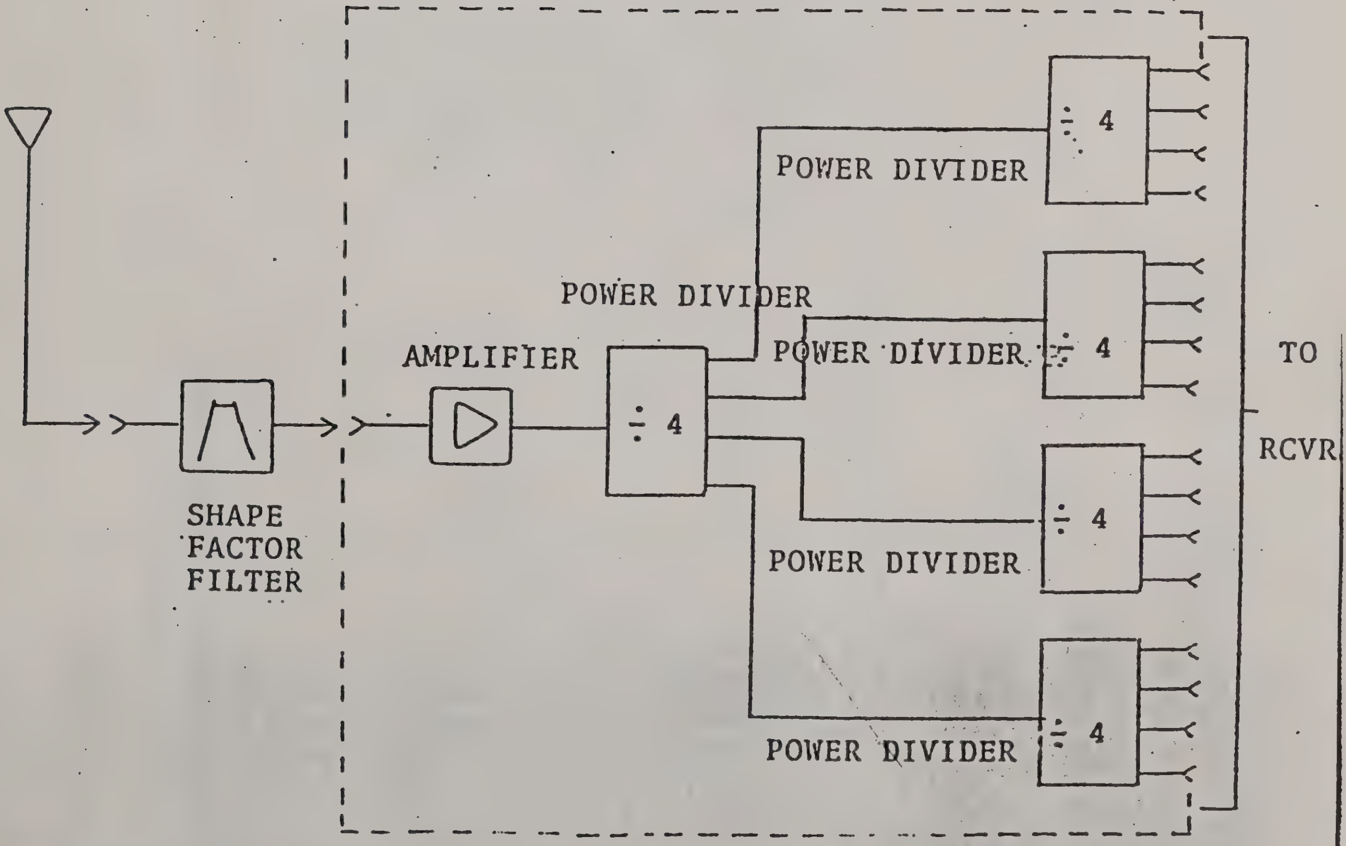
NOTE:

Any unused ports of the power divider must be terminated in 50 ohms. Failure to do so results in unequal power splitting, reduced isolation, and high VSWR.

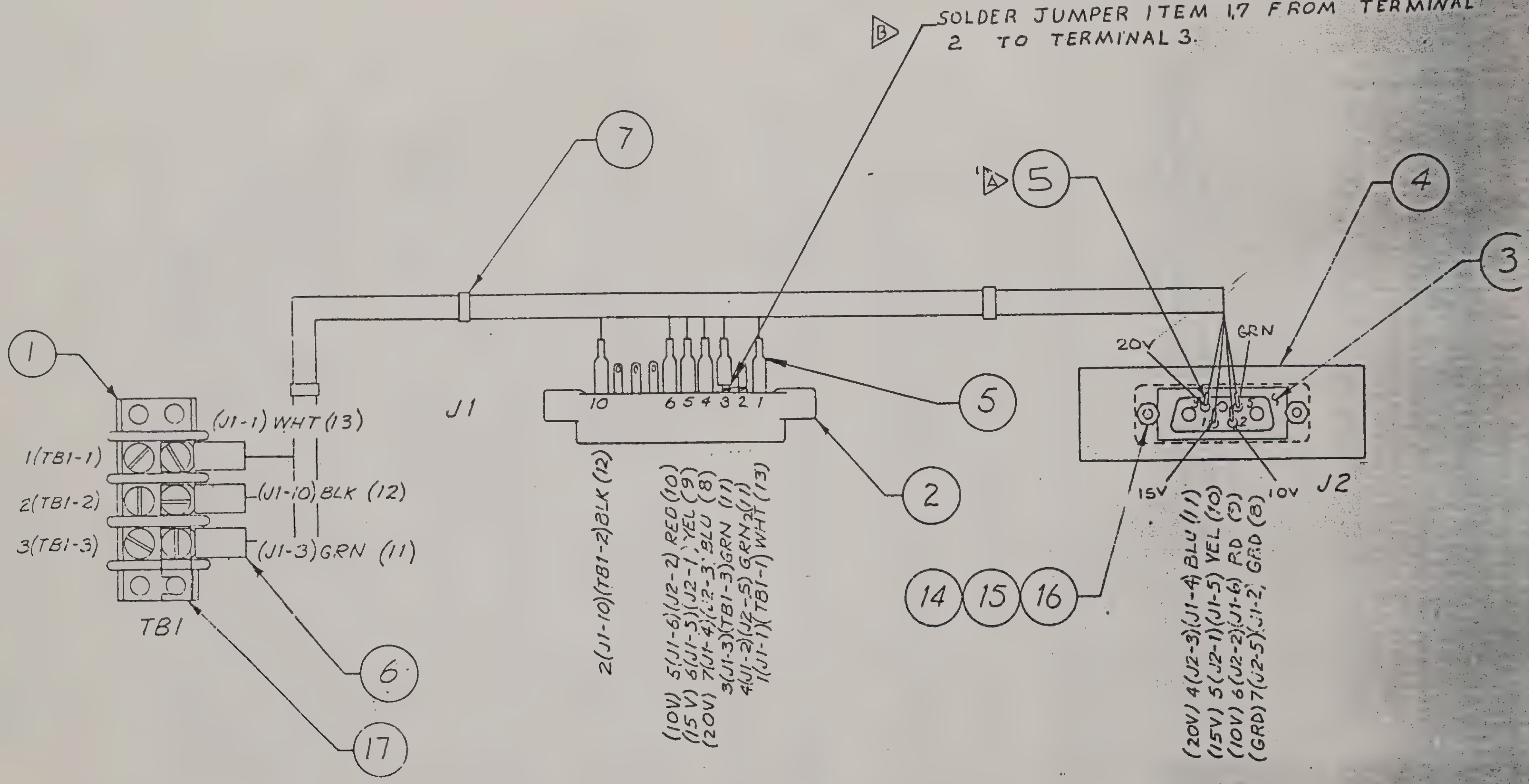
CHANNEL RECEIVER MULTICOUPLER



4 CHANNEL RECEIVER MULTICOUPLER



16 CHANNEL RECEIVER MULTICOUPLER


B
SOLDER JUMPER ITEM 1,7 FROM TERMINAL 2 TO TERMINAL 3.
7
A
5
4
3
1
(J1-1) WHT (13)
1(TB1-1)
2(TB1-2)
3(TB1-3)
(J1-10) BLK (12)
(J1-3) GRN (11)
TB1
6
17
J1
10
6 5 4 3 2 1
5
2
2(J1-10)(TB1-2)BLK (12)
(10V) 5(J1-6)(J2-2) RED (10)
(15 V) 6(J1-5)(J2-1) YEL (9)
(20V) 7(J1-4)(J2-3) BLU (8)
3(J1-3)(TB1-3)GRN (11)
4(J1-2)(J2-5) GRN$_2$(11)
1(J1-1)(TB1-1) WHT (13)
20V
GRN
15V
10V
J2
14
15
16
(20V) 4(J2-3)(J1-4) BLU (11)
(15V) 5(J2-1)(J1-5) YEL (10)
(10V) 6(J2-2)(J1-6) RD (9)
(GRD) 7(J2-5)(J1-2) GRD (8)

WIRING DIAGRAM - RECEIVER MULTICOUPLER

(WIRING HARNESS)

DB4176 DB4177 DB4181

SHAPE FACTORED FILTER

GENERAL

DB4176	The DB4176 consists of six (6) quarter-wave cavities mounted on two (2) individual 19-inch panel with three (3) cavities per panel. The cavities are interconnected to produce an optimum coupled bandpass response. The DB4176 is designed to have a 4 MHz pass bandwidth (fo ± 2 MHz) with 2dB insertion loss across the band in the 450 MHz to 512 MHz frequency range.
DB4177	The DB4177 consists of eight (8) quarter-wave cavities mounted on two (2) individual 19-inch panels. It is designed for a narrower pass bandwidth (fo ± 1 MHz) and sharper skirt selectivity to provide higher isolation of out-of-band frequencies than the DB4176.
DB4181	The DB4181 consists of four (4) quarter-wave cavities mounted on a single 19-inch panel. It is designed to pass a 2.5 MHz (fo ± 1.25 MHz) band in the 800 MHz frequency range.

INSTALLATION INSTRUCTIONS

These instructions are included for the multi-panel DB4176 and DB4177 units. Figure 3 shows the installation of the DB4181.

1. Place both halves of the filter into the rack as shown in Figure 1 or 2 (Figure 1 pertains to the DB4176; Figure 2 pertains to the DB4177).
2. Sever the ty-wrap securing color coded interconnect cable.
3. Connect interconnect cable to the color coded connector. The color on the interconnect cable and connector must match.
4. Installation of unit is complete. Connect antenna cable in the input connector, indicated by the input frequency label, and receiver cable to the output connector.

TUNING INSTRUCTIONS

The shape factored filter is factory-tuned to the exact operating frequencies and shipped ready for immediate installation. No further tuning or adjustment is required. If it becomes necessary to change the operating frequencies, it may be returned to the factory for retuning or may be retuned if the following equipment is available:

1. A swept amplitude measurement system (ie, spectrum analyzer and tracking generator, frequency response test set, network analyzer, etc). A measurement system that visually displays amplitude response versus frequency is a must.

2. A directional coupler.

PROCEDURE

The retuning procedure can be separated in to two (2) distinct areas: 1. Minor shift in frequency, 2 Major shift in frequency.

1. When it is desired to retune unit within 2 MHz of orginal center frequency, the entire response can be moved in frequency by tuning the individual cavities and sliding the entire response either up or down in frequency. Clockwise rotation of movable center conductor adjustment lowers the frequency of the cavity.

2. If frequency shift of more than 2 MHz from center frequency is desired, the measurement system should be set up to measure return loss (VSWR), then proceed as follows:
    a.) Tune input cavity for minumum return loss (minimum VSWR). The value of return loss, depending on new and original center frequency, may be in the 4dB to 5dB range.

    b.) Tune the second cavity for maximum return loss. The response curve should resemble an over-coupled, double tuned circuit response.

    c.) Tune the third cavity for minimum return loss.

    d.) Continue to tune the remainder of the cavities according to the dip-peak method.

    e.) When all the cavities are tuned, consider entire return loss response and optimize for best overall response.

NOTE: The response of the shape factored filter can be altered (increased pass band ripple and decreased pass bandwidth) by input impedence of a non-50 OHM device.

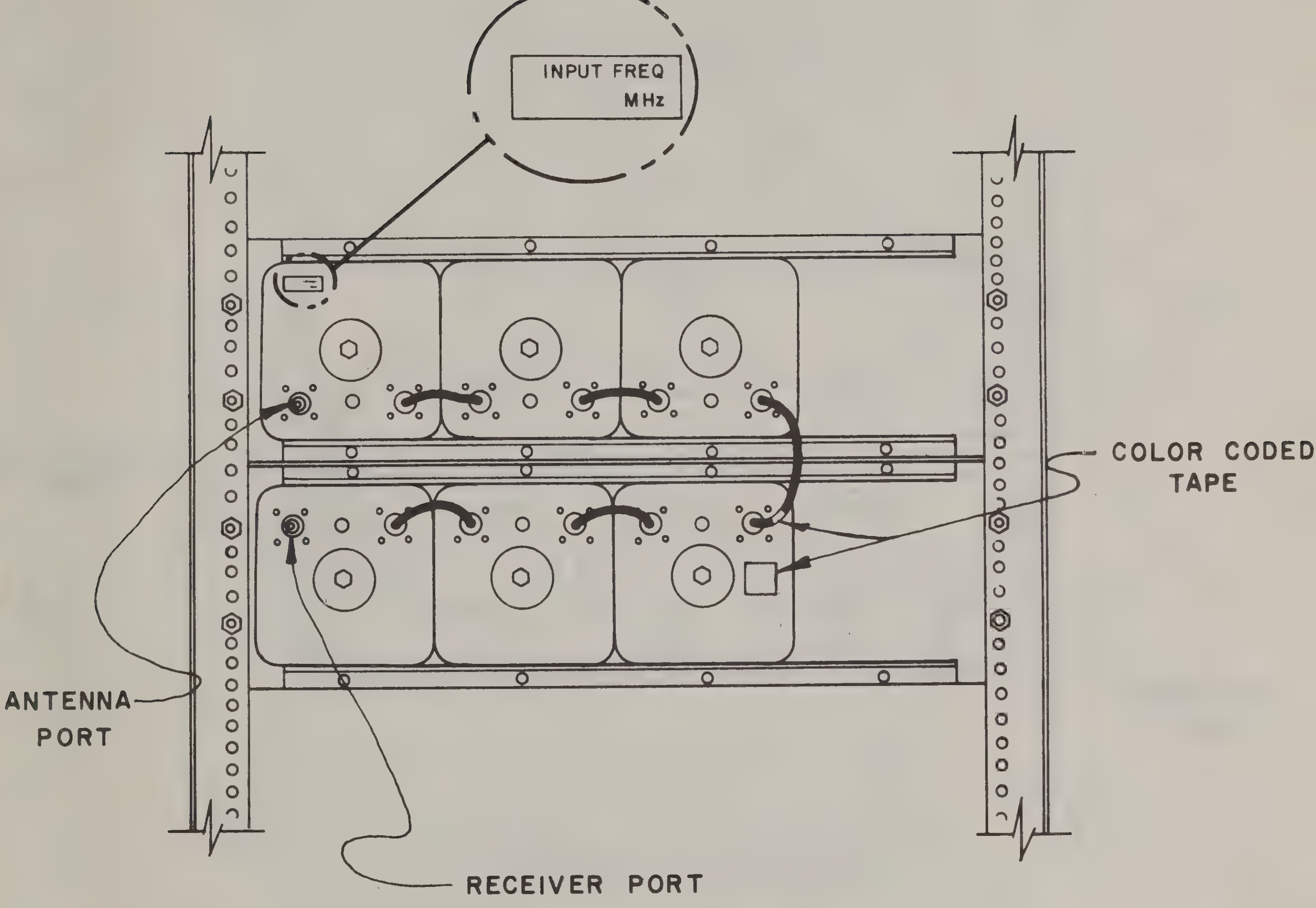


FIG. 1

DB 4177

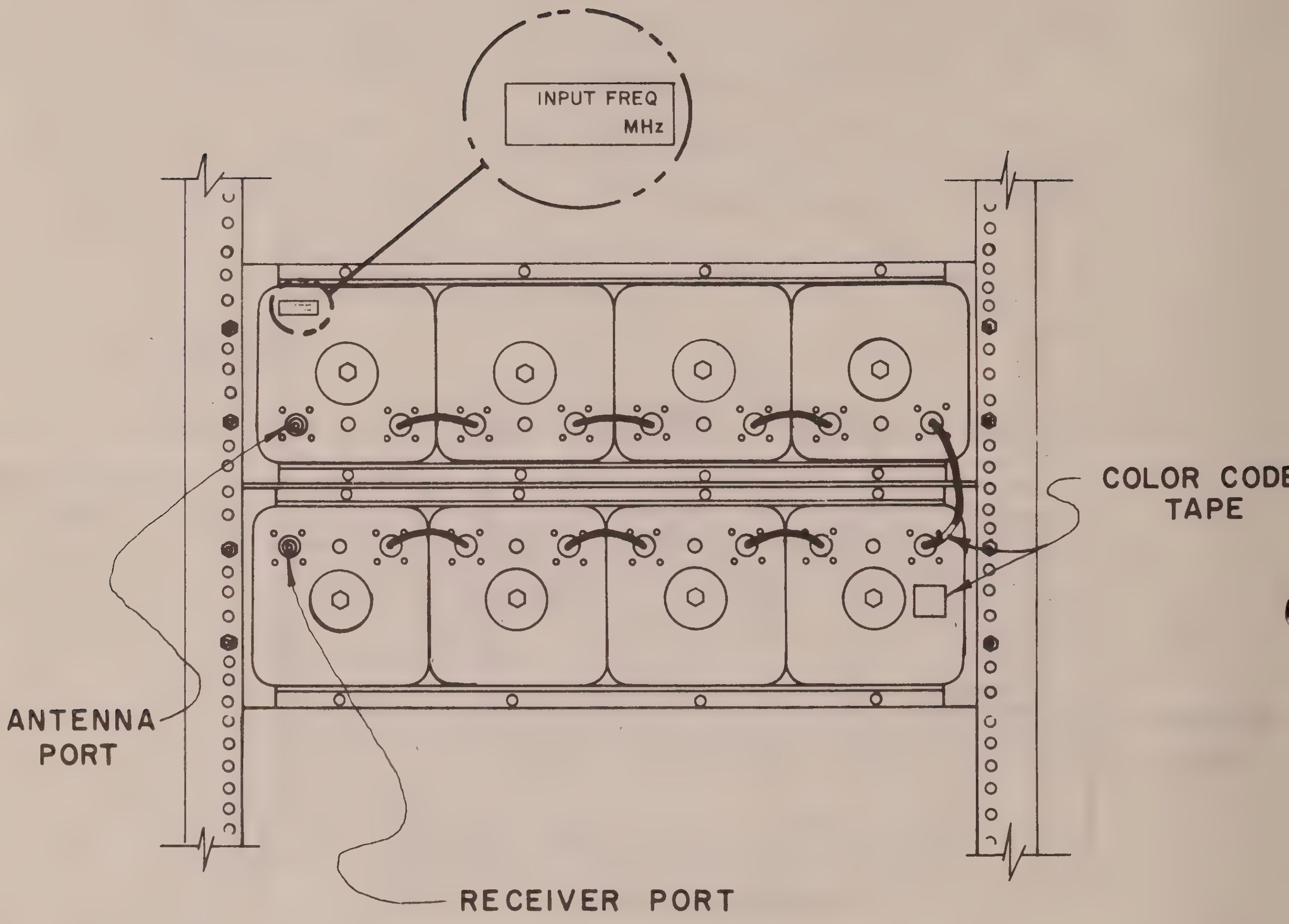


FIG. 2

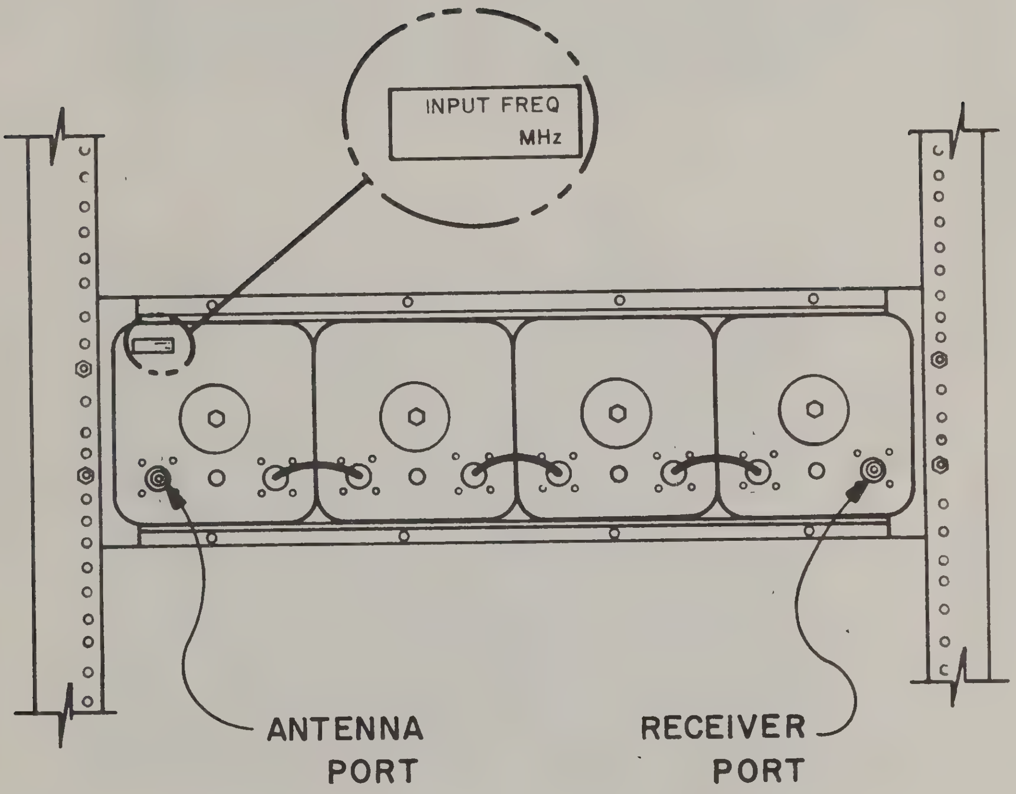


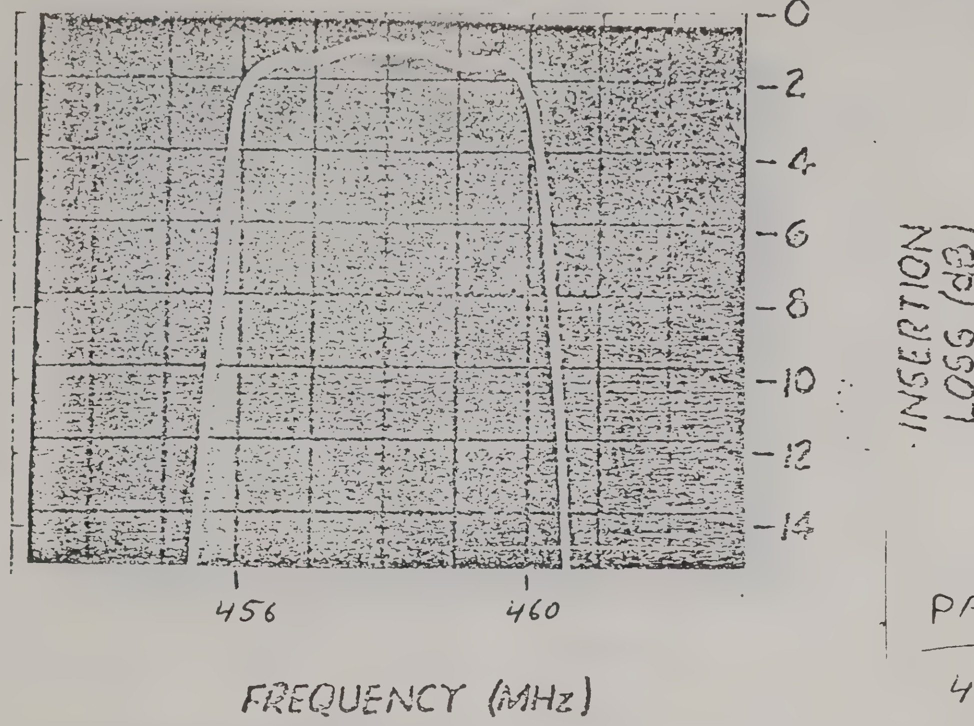
FIG. 3

DB-4176 SHAPE FACTOR FILTER

ONE HALF OF SP4626-B

SHIP TO:
QUIGLEY COMM.

1 MHz
PER DIV. →

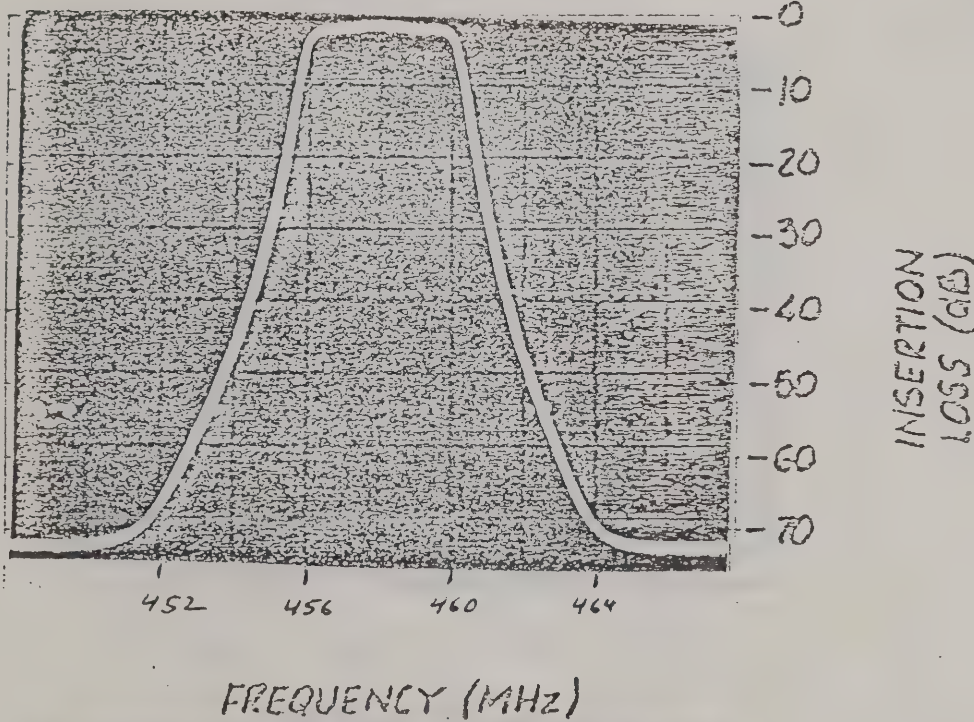


SER # D60720

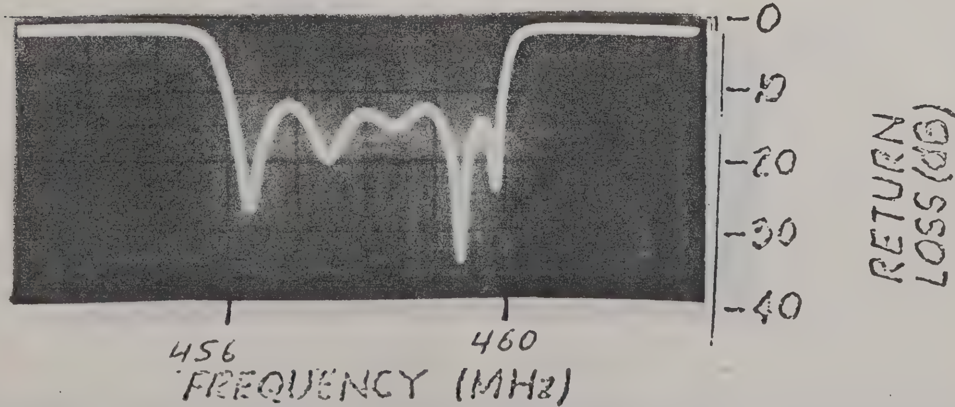
PASS BAND

456.0 – 460.0 MHz

2 MHz
PER DIV. →



1 MHz
PER DIV. →



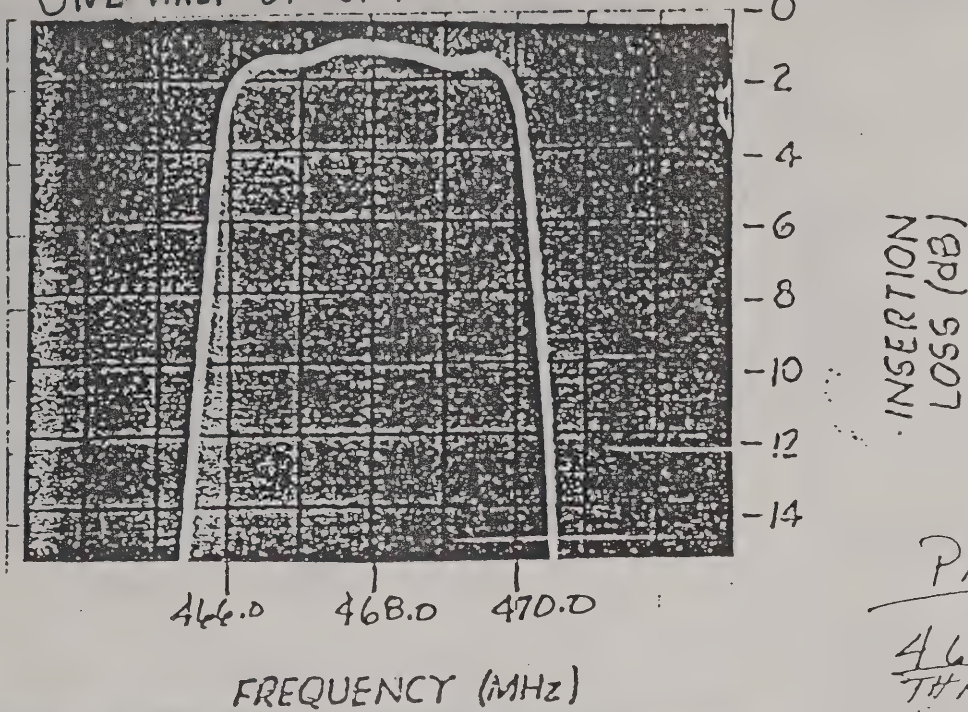
dB	VSWR
9	2.10:1
10	1.92:1
14	1.50:1
19	1.25:1

DB-4176 SHAPE FACTOR FILTER

ONE HALF OF SP4626-B

SHIP TO:
QUIGLEY COMM,

1 MHz
PER DIV.

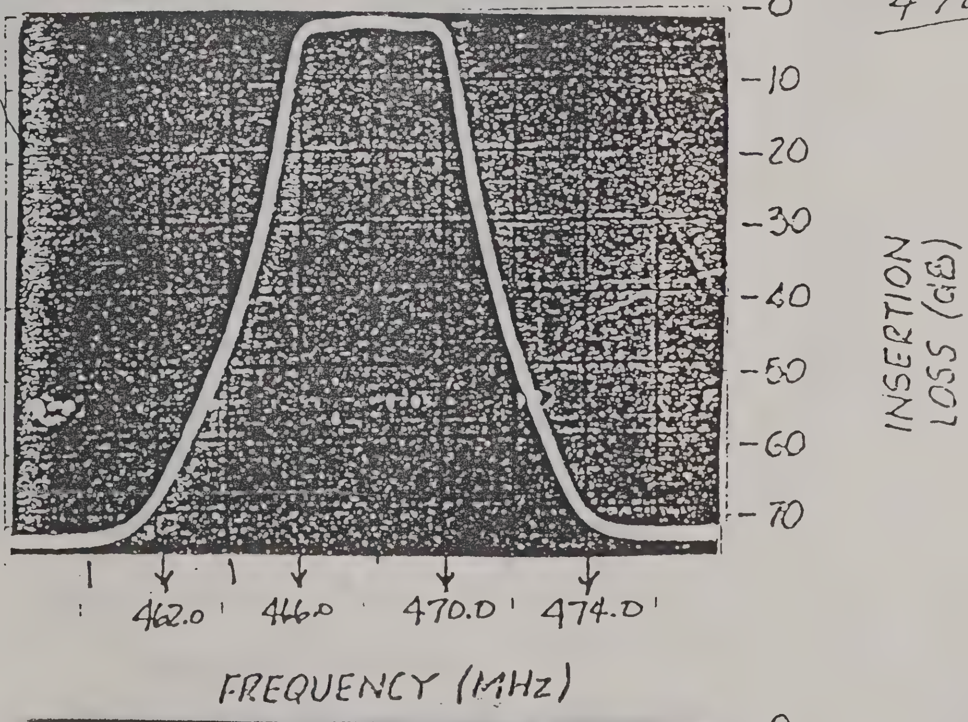


SER # DG072

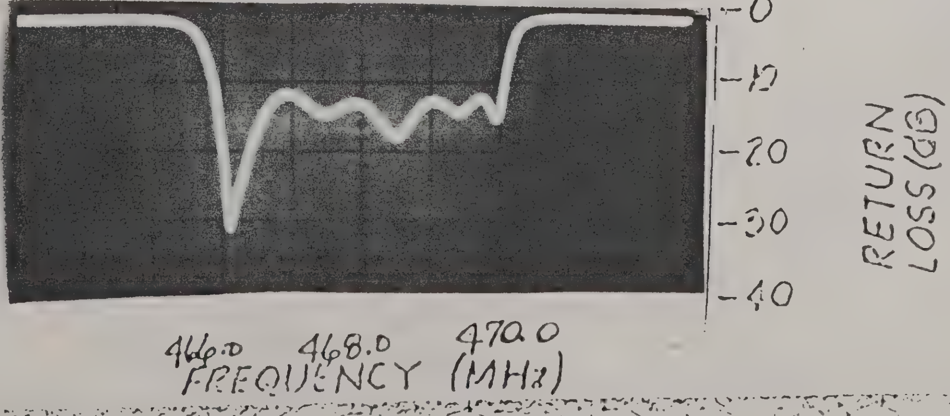
PASS BAN

466.00 MH
THROUGH
470.000 MH

2 MHz
PER DIV.



1 MHz
PER DIV.



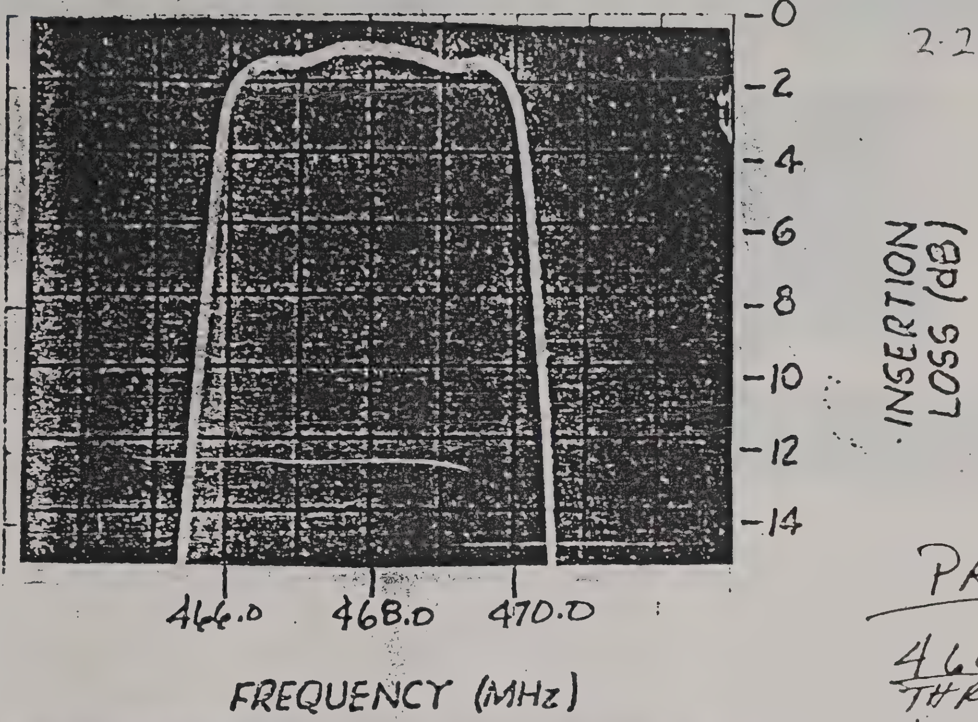
dB	VSW
9	2.10:
10	1.92:
14	1.50:
19	1.25:

DB-4176 SHAPE FACTOR FILTER

SHIP TO:
QUIGLEY COMM.
2-2-83

SER # 41577

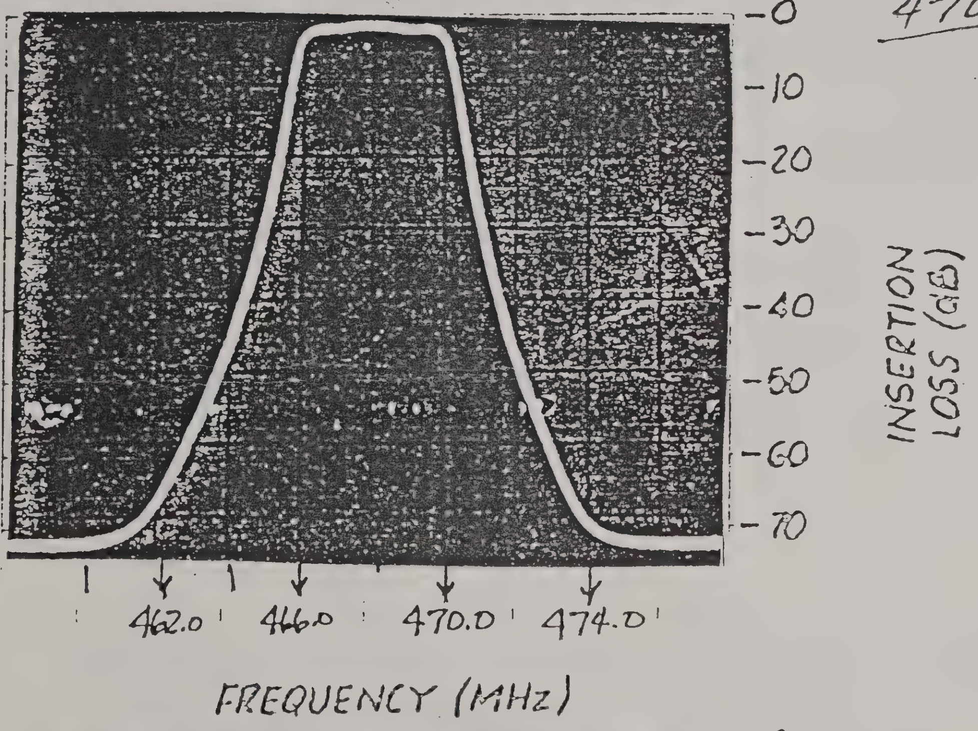
1 MHz
PER DIV.
→



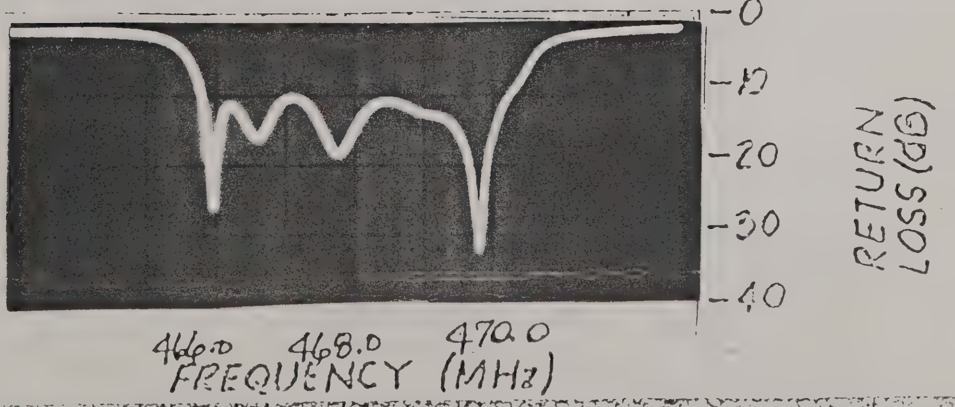
PASS BAND

466.00 MHz
THROUGH
470.000 MHz

2 MHz
PER DIV.
→



1 MHz
PER DIV.
→



dB	VSWR
9	2.10:1
10	1.92:1
14	1.50:1
19	1.25:1

Decibel
Products,
Inc.

TOWER TOP RECEIVER AMPLIFIER

406 – 512 MHz   800-850 MHz

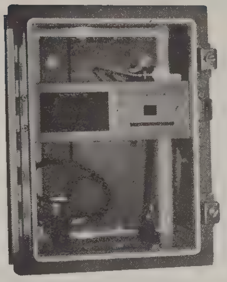
DB-8980 DB-8983
DB-8982 DB-8984

APPLICATION. Decibel's Tower Top Amplifiers improve the sensitivity of the base station receivers and extend the "talk back" range for low power transmitters operating in the 450-512 MHz and 806-821MHz frequency bands. Receiver performance is improved by placing high gain, low noise amplifiers at the antenna terminal to overcome the usual transmission line and pre-selection filter loss that adds to the receiver noise figure which degrades receiver sensitivity.

LIGHTNING. Lightning is of great concern when an active device is placed at the top of the tower. To minimize lightning failures, several levels of protection have been incorporated. At the point where the antenna coax enters the enclosure, a shorted quarter-wave stub brings the center conductor and the outer conductor of the coax to the same potential. The center conductor of the preselector filter is also tied to its outer conductor. This insures that any high currents or high voltage differentials at the input will be minimized. Protecting the output is more difficult since there is dc on the center conductor. Gas discharge tubes and high-current zener diodes in the bias tee circuitry provide protection at this point.

DB-8980. Tower Top Receiver Amplifier provides 20dB gain at the antenna terminals for signals in the 806-821MHz frequency range. The low noise, high gain amplifier is preceded by a shape factored filter (DB-4190) which has a 15MHz pass-band with high out of band rejection characteristic. The amplifier is supplied DC power through the transmission line by use of a bias tee arrangement. A relay within the unit permits switching the amplifier in or out of the circuit, if required. The top assembly is supplied in a weatherproof enclosure with suitable lightning protection. The bias power supply unit is mounted on a 3.5-inch chassis for standard 19-inch rack mounting. The amplifier and power supply are modular, plug-in construction for ease of field maintenance.

DB-8982. Tower Top Receiver Amplifier provides 20dB gain at the antenna terminals for signals in the 406-512MHz frequency range. The low noise, high gain amplifier is preceded by two parallel UHF Shape Factored Filters (DB-4176). Each filter has a 4MHz essentially flat, passband with high rejection at signals 5MHz from band edge. Each filter consists of six High Q, coaxial cavities optionally coupled for a uniform passband with sharp rejection and can be tuned through the band. DC power is supplied through the transmission line and relay switching is provided in the same way as the DB-8980.



TOP
AMPLIFIER
AND
PRESELECTOR

RACK
MOUNT
POWER
SUPPLY

DB-8983. Tower Top Receiver Amplifier combines the performance and functions of the DB-8980 and DB-8982 receiver amplifiers combined in one weatherproof enclosure. In similar fashion the DB-8983 makes use of modular plug-in components, bias tee DC Power supply housed in a weatherproof enclosure with relay switching to remove the amplifier from the receiver circuitory.

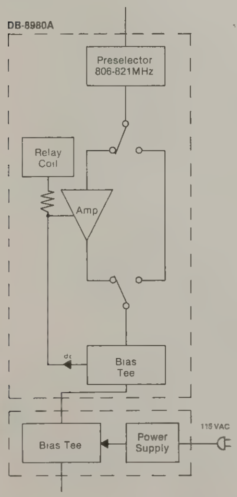
DB-8984 is a unique combination of amplifier and crossband coupler allowing reception at 450 and 800MHz simultaneously using one transmission line. Amplification at 800MHz is provided by a DB-8980 amplifier, while the 450MHz antenna is connected directly to the transmission line through the crossband coupler.

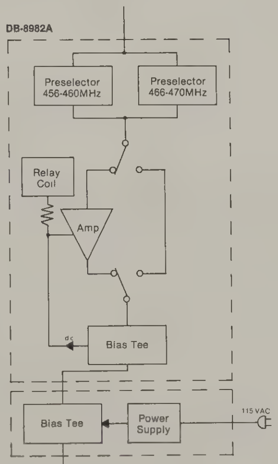
ELECTRICAL SPECIFICATIONS

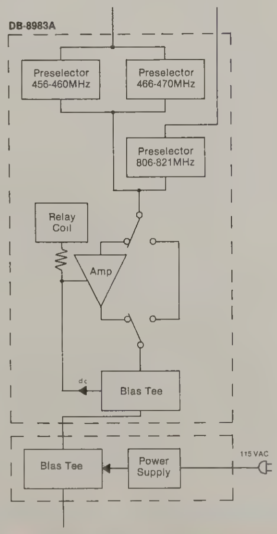
	DB-8980	DB-8982	DB-8984	DB-8983
Frequency	806-821MHz	456-460MHz 466-470MHz	806-821MHz 406-512MHz	456-460MHz 466-470MHz 806-821MHz
Gain (min.)	20dB	20dB	20dB 0dB @ 406-412MHz	20dB
Noise Figure	3.5dBM	3.5dBM	3.5dBM	3.5dBM
3rd Order Intercept Point	+35dB	+35dB	+35dB	+35dB
Temperature Range	−40°C to +70°C	−40°C to +70°C	−40°C to +70°C	−40°C to +70°C
Power	115 VAC	115 VAC	115 VAC	115VAC

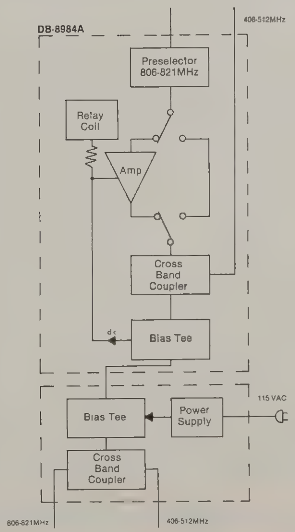
MECHANICAL SPECIFICATIONS

	DB-8980 DB-8982 DB-8984 DB-8983
Size (Top Enclosure)	16 × 12 × 10 Inches
Size (Bottom Panel)	3.5 × 19 × 10 Inches deep
Connector	Type N Female









ORDERING INFORMATION

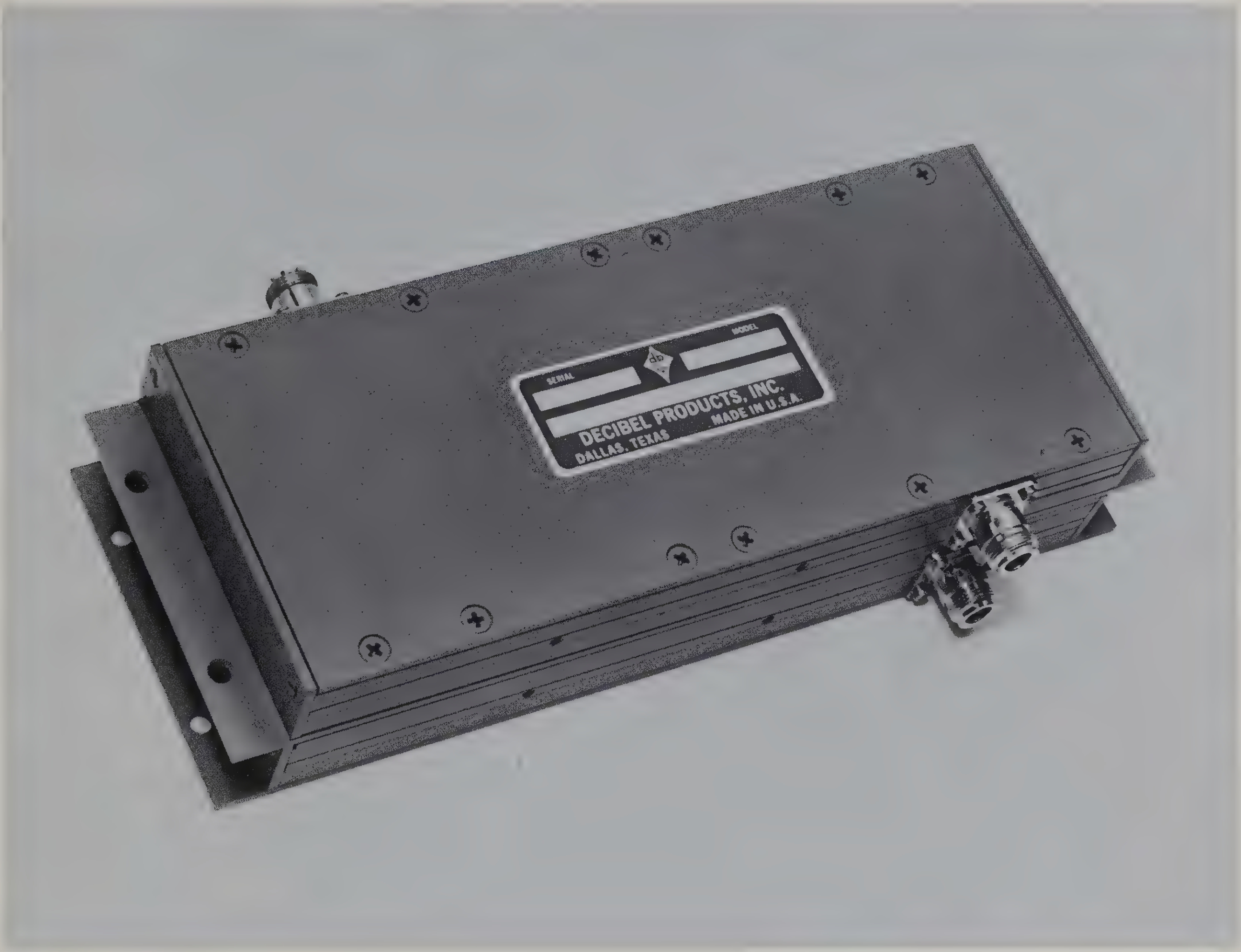
Order by model number and frequency

NEW!

Decibel
Products,
Inc.

PRELIMINARY

SHAPE FACTORED FILTERS®



Features:

- 406-512MHz
- 806-960MHz
- 15MHz - 1dB Bandwidth at 800 MHz
- 4MHz - 1dB Bandwidth at 406 to 512MHz
- Small Size
- Low Cost
- 19" Panel Mount

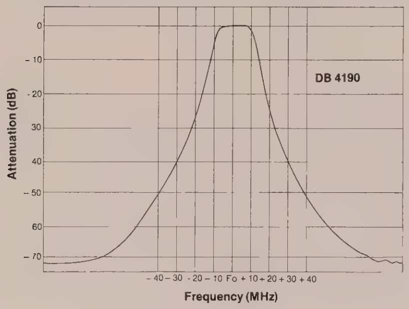
Decibel has combined our Shape Factored Filter® techniques with the Interdigit Filter technology and come up with a superior line of window type filters that are used for receiver multicoupler preselectors.

PRELIMINARY SPECIFICATIONS

Electrical

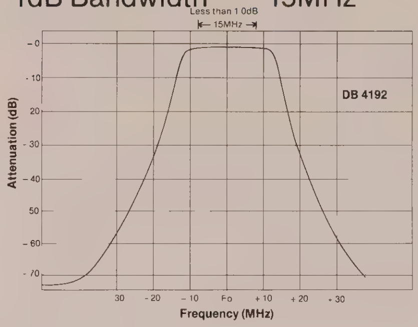
DB 4190

Insertion loss	.7dB
1dB Bandwidth	15MHz



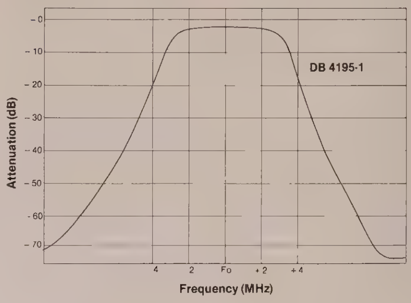
DB 4192

Insertion loss	1dB
1dB Bandwidth	15MHz



DB 4195-1

Insertion loss	2dB
1dB Bandwidth	4MHz



Mechanical

	DB 4190	DB 4192	DB 4195-1
Dimensions (H X W X D)	8¾" X 19" X 1"	8¾" X 19" X 1"	12¼" X 19" X 1"
Finish	Decibel Brown	Decibel Brown	Decibel Brown
Connectors	N Female	N Female	N Female

Mounting: 19" Panel mount (Tray mount with 5¼" X 19" panel optional)

"The Measurement of Performance"

Decibel Products, Inc.

A SUBSIDIARY OF COMMUNICATIONS INDUSTRIES, INC.

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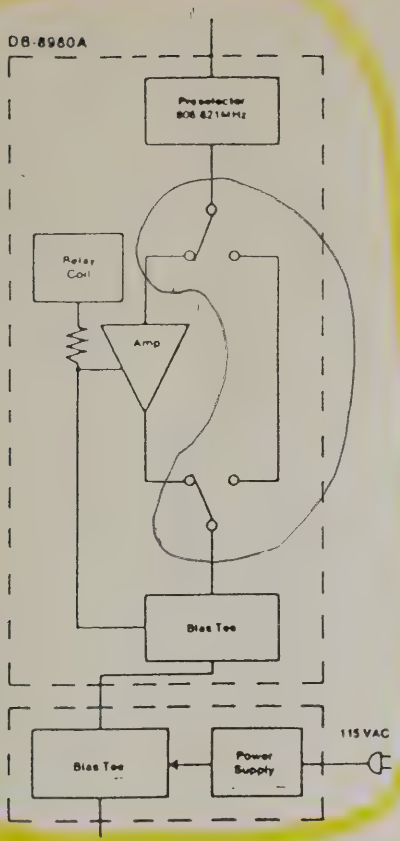
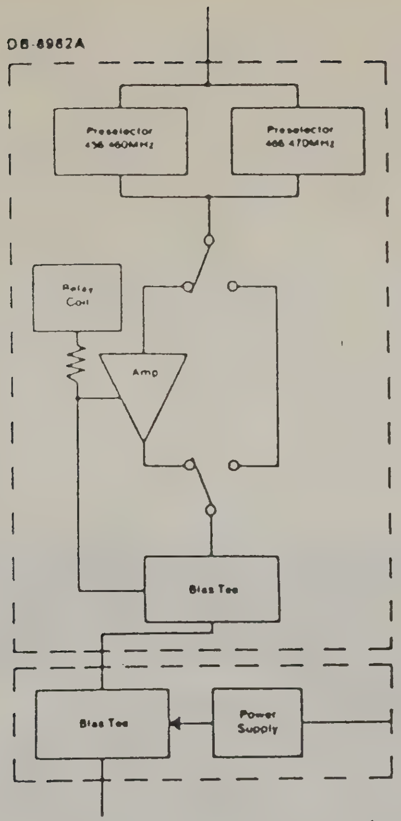
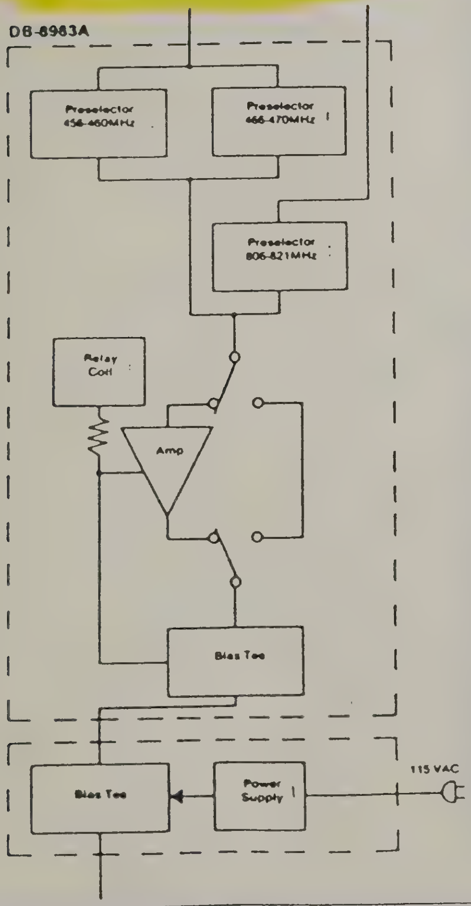
DB-8980A



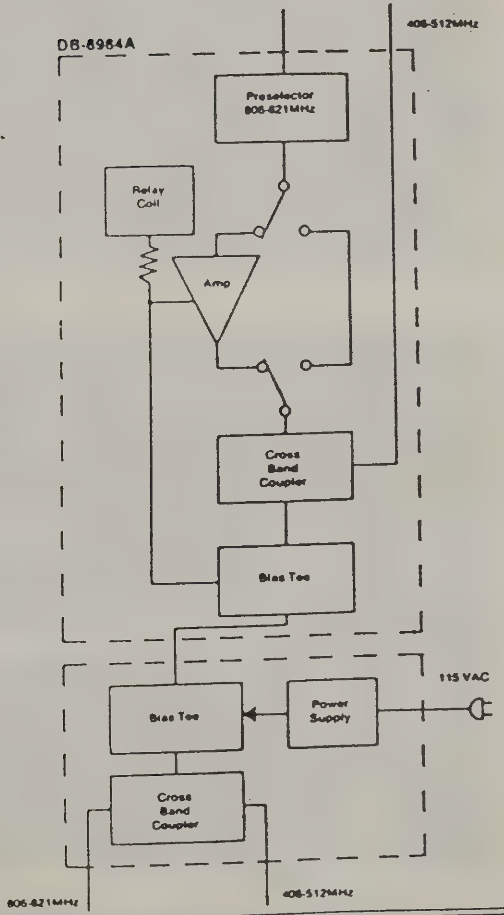
DB-8982A



DB-8983A



DB-8984A



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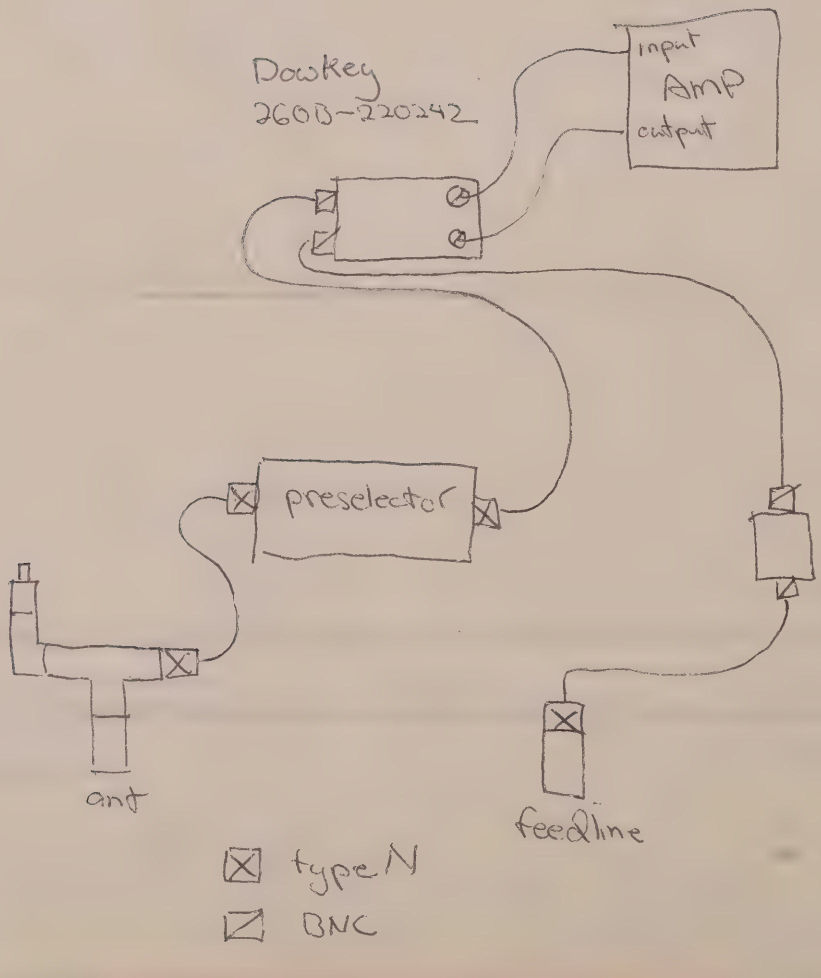
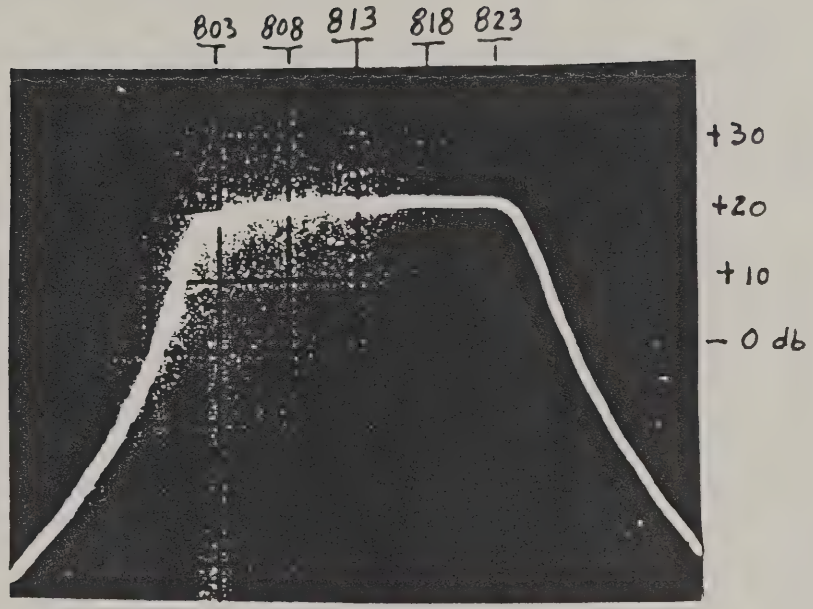
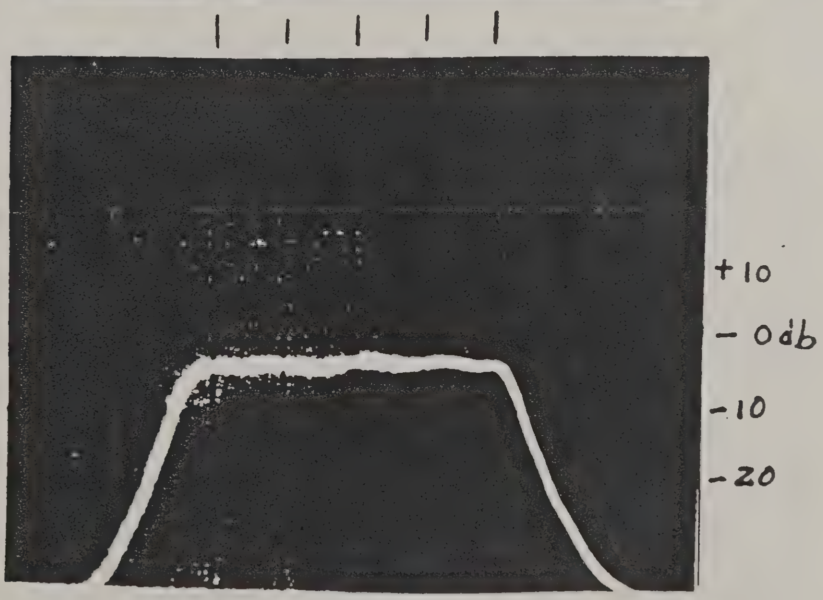

Dowkey
260B-220242
input
Amp
output
preselector
ant
feedline
☒ type N
◪ BNC

AMPLIFIER "ON"

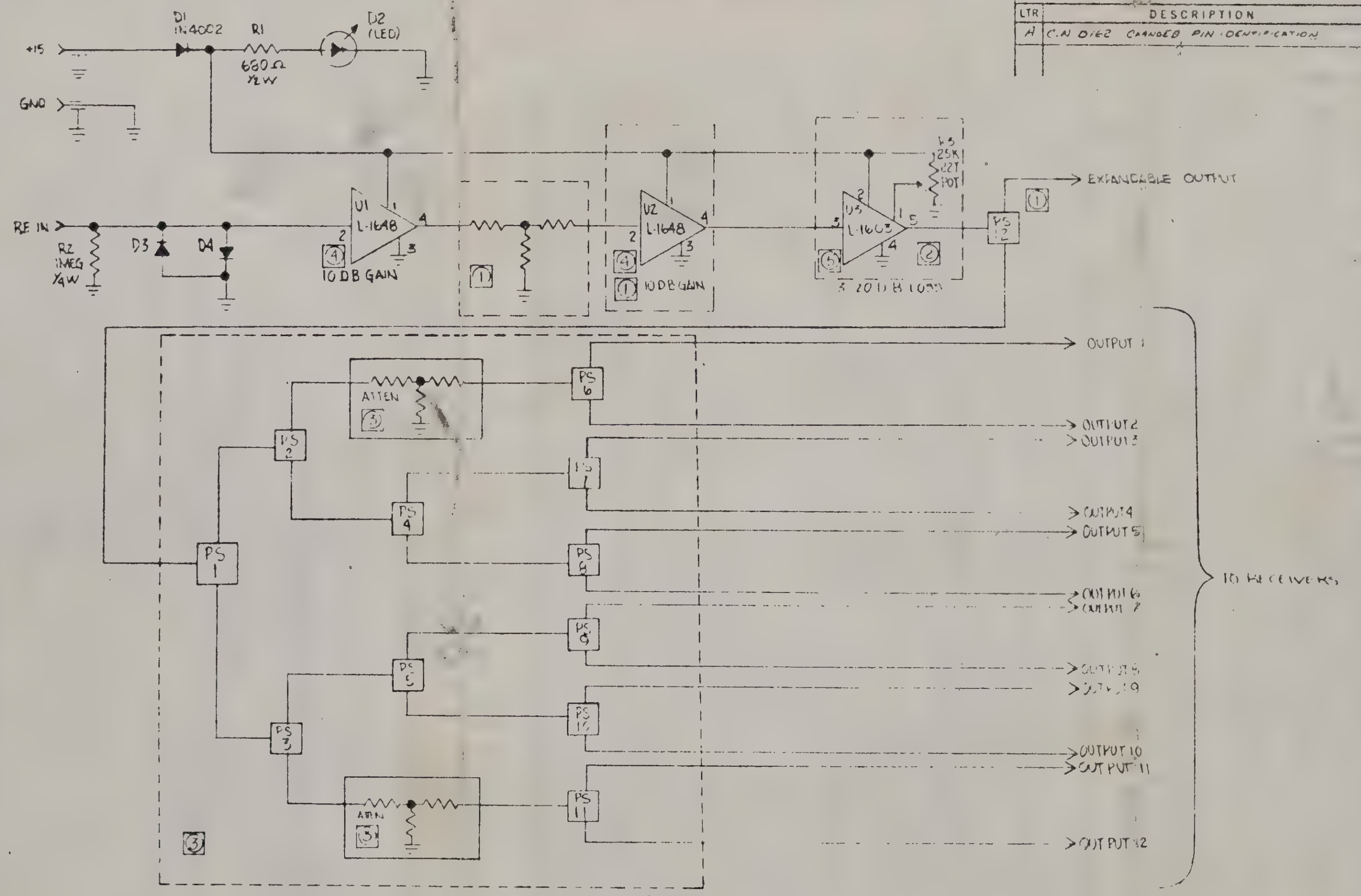


AMPLIFIER "OFF"



-1996 REV A

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	C.N 0162 CHANGED PIN IDENTIFICATION		



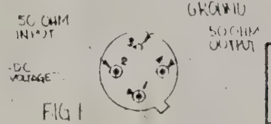


FIG 1

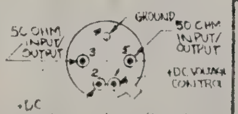


FIG 2

NOTES:

- 5 FIGURE 2 FOR PIN IDENTIFICATION
- 4 FIGURE 1 FOR PIN IDENTIFICATION
- 3 NO OF POWER SPLIT & ATTEN MAY VARY WITH NO OF OUTPUTS
- 2 IN UNITS WITH 'C' AT END OF MODEL NO ONLY
- 1 FACTORY SELECT NOT IN ALL UNITS

UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES
FRACT ±1/64 DEC ANGLES ±0° 30'
MACHINE SURFACES 125✓
MATERIAL

CONTRACT NO

	SIGNATURE	DATE
DR BY		9/78
CHK BY		
APPD BY	R. Fell	9-22-79
APPD BY		

DESIGN ACTIVITY APPROVAL
APPROVAL

MICROWAVE ASSOCIATES, INC.
830 A STEWART DR SUNNYVALE CALIFORNIA 94086

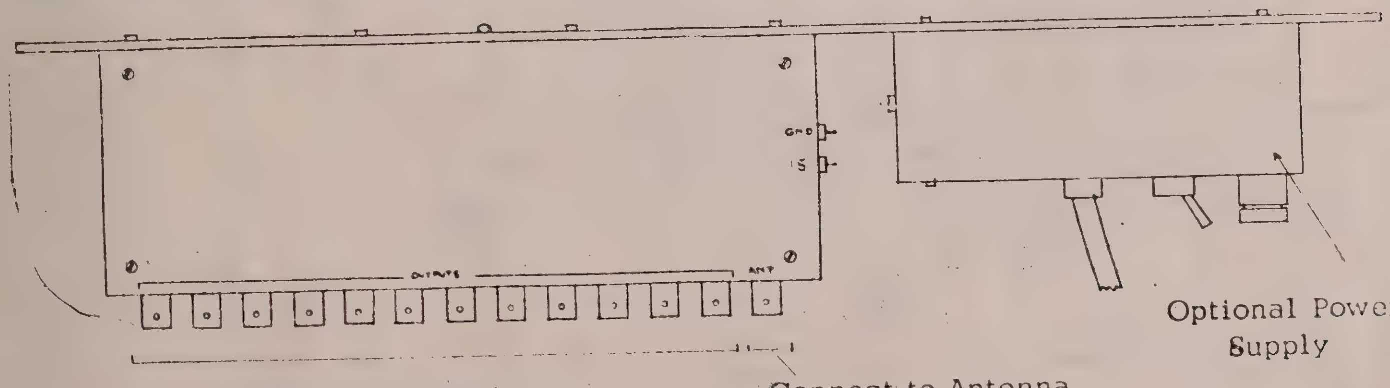
SCHEMATIC OF RECEIVER COMBINER

SIZE	CODE IDENT NO	DRAWING NO
C	96067	

SCALE SHEET OF

RECEIVER COMBINER INFORMATION AND INSTRUCTIONS

This Receiver Combiner represents the latest advance in the state-of-the-art for this category of device in terms of electrical performance, stability, reliability and compactness. The circuitry consists of a thin film, solid state amplifier and flat pack power dividers mated to an etched and plated 50 ohm microstrip board. Both amplifier and dividers are hermetically sealed at the factory against moisture, dirt and other contamination, and the completed combiner is 'burned in' following electrical test for a minimum of 48 hours. The transistors used in the amplifier are bi-polar transistors and as such are not subject to static burnout as are FET transistors. RF input power to the transistor, however, must not exceed 200 mW maximum at any time. A diode limiter has been incorporated into the microstrip trace leading from the antenna port to the amplifier to help protect it from high power, such as might be generated by nearby lightning strikes. It provides progressively increasing insertion loss to incoming high level RF energy, starting with about 0.3 dB attenuation at 1 milliwatt to 20 dB attenuation at 20 watts. The limiter should not be looked upon as a cure-all for combating the effects of high level incoming signals generated by on-site transmitters. While it should protect the amplifier against burn out, the intermodulation and distortion performance of the combiner would be degraded any time the high level signals are present. Free space losses between the Receiver Combiner's antenna and nearby transmitter antennas must be considered when using this (or any) Receiver Combiner if optimum performance is to be achieved. The PLUS supply line has a diode installed to prevent damage to the amplifier in the event it is accidentally wired up backward in the field. Further, the amplifier is heat sinked to the outer sufrace of the box to insure continued, stable operation, even in the severest of environments. Industry-wide, the instance of failure for this type of device has shown itself to be extremely low, and, in fact, calculations for MTBF of the amplifier put the number at something in excess of a million hours. Because of this and of the care with which MICROWAVE ASSOCIATES, INC. has assembled and tested this unit, no scheduled field service is required. In the event the amplifier is burned out by high power, it is replaceable in the field. The procedure is simple and takes only a few minutes to complete right at the site. The replacement amplifier is Model No. L-1648. With it is supplied installation instructions and heat sink compound. It comes from the factory with 'burn-in' already completed.



Optional Power Supply

Connect to Receivers-
terminate unused ports
in 50 ohm.

Connect to Antenna

Connect '+' to PLUS supply.
Connect '-' to MINUS supply.
Units coming from factory with
optional power supply will
already be wired.

(OVER)

TUNING INSTRUCTIONS
DB-8060 OR DB4500-2

SPECTRUM ANALYZER METHOD

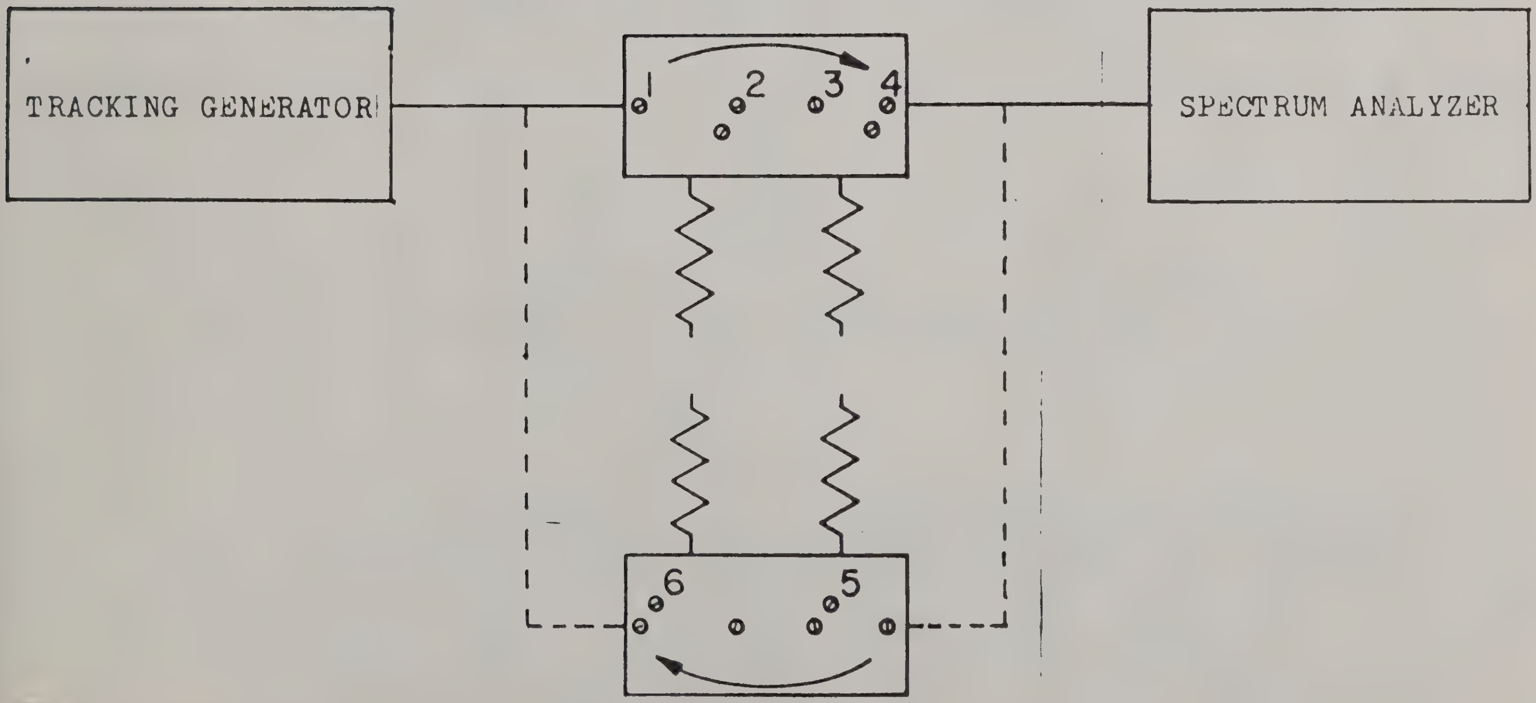
1. Disconnect the phasing cable assembly from each cavity.
2. ~~Adjust cavity loops for proper insertion loss (see chart)~~ → N/A FOR DB4500-2
3. Tune test equipment to desired frequency.
4. Connect leads of spectrum analyzer to ~~isolator input and~~ cavity output. INJECT DESIRED FREQUENCY AT ISOLATOR INPUT.
5. Adjust cavity and isolator (see isolator tuning instructions) for minimum insertion loss.
6. Reverse test leads and tune isolator for maximum isolation.
7. Repeat Step 5.
8. Repeat the above procedure for all the remaining channels.
9. Reconnect all channels to the phasing cable assembly.
10. Connect test leads of spectrum analyzer to ~~isolator input and~~ antenna port. INJECT DESIRED FREQUENCY AT ISOLATOR INPUTS
11. Tune cavity for minimum insertion loss.
12. Due to interaction between channels Step 11 may have to be repeated.
13. The combiner should now be ready for operation.

TUNING INSTRUCTIONS

DUAL JUNCTION ISOLATORS

SPECTRUM ANALYZER METHOD

1. Tune the equipment to desired frequency.
2. Place the isolator between the tracking generator and spectrum analyzer in the foward direction (arrow pointing to the spectrum analyzer).
3. Tune capacitors 1-4 for minimum insertion loss.
4. Reverse the isolator so that the arrow points toward the tracking generator.
5. Tune capacitors 5-6 for maximum isolation.
6. Repeat steps 2-3.



FIELD TUNING INSTRUCTIONS
DB-4316 and DB4317
DUAL JUNCTION TUNEABLE ISOLATORS

NOTE: Tuning should be performed at a reduced power level (10-20 watts).

Referring to Figure 1:

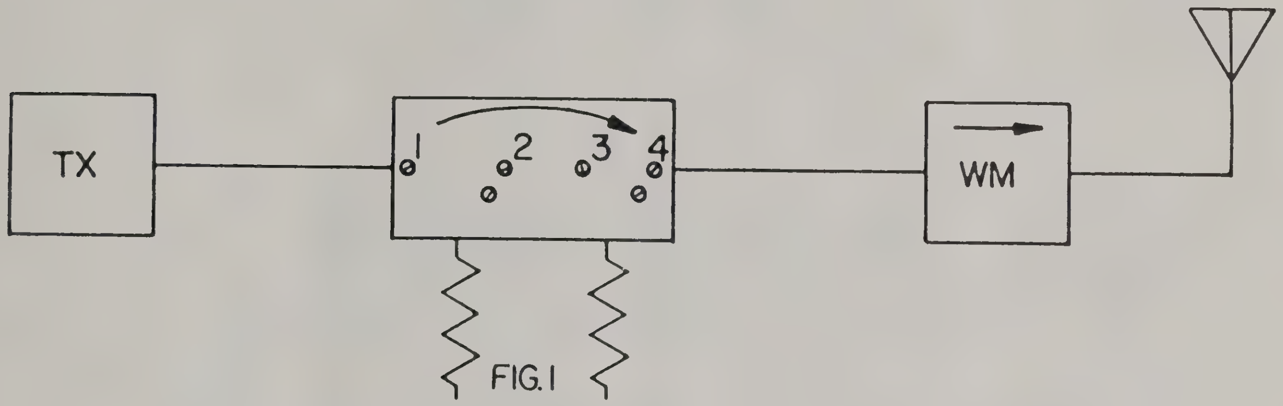


FIG.1

1. Place the isolator in the transmission line in the forward direction (arrow pointing to antenna or load). Tune capacitors 1, 2, 3 and 4 for minimum loss (maximum power) at the power meter connected as shown above.

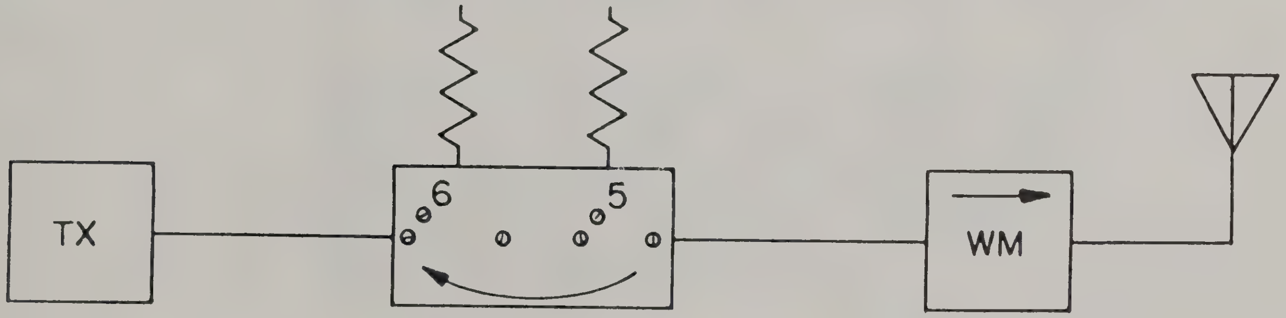


FIG.2

2. Reverse the isolator in the transmission line (see Figure 2) so that the arrow is pointing towards the transmitter. Now adjust capacitors 5 and 6 for minimum power (maximum isolation) at the power meter. Use the appropriate power meter scale (or slug) to provide for low level meter sensitivity. Adjust capacitor 5 before adjusting 6. Note: Since the transmitter power is absorbed by the load termination near capacitor 6, this load will get hot if the transmitter is keyed for very long.

Now connect equipment as shown in Figure 3.

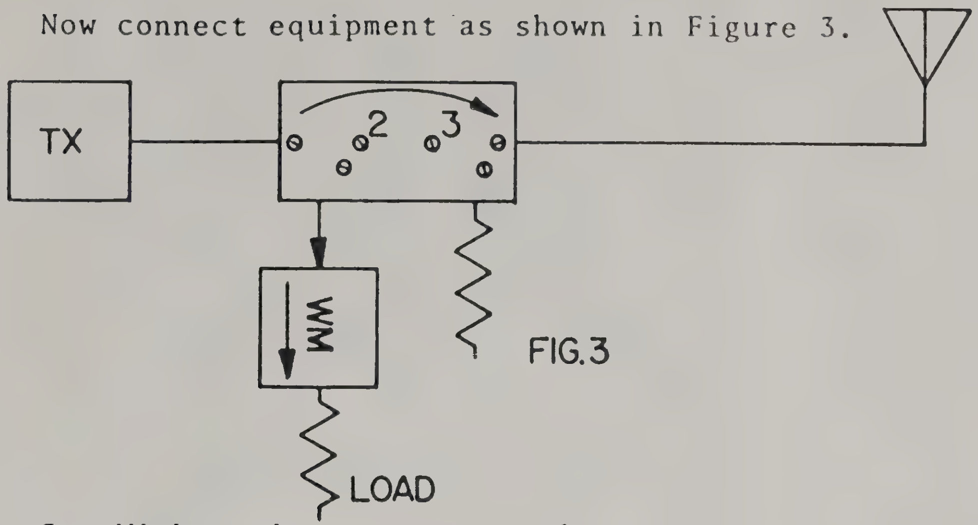


FIG.3

3. With equipment connected as shown in Figure 3 Very slightly re-adjust capacitors 2 and 3 only such that the wattmeter shows minimum forward power. Use the lowest power level (most sensitive) wattmeter insert available.

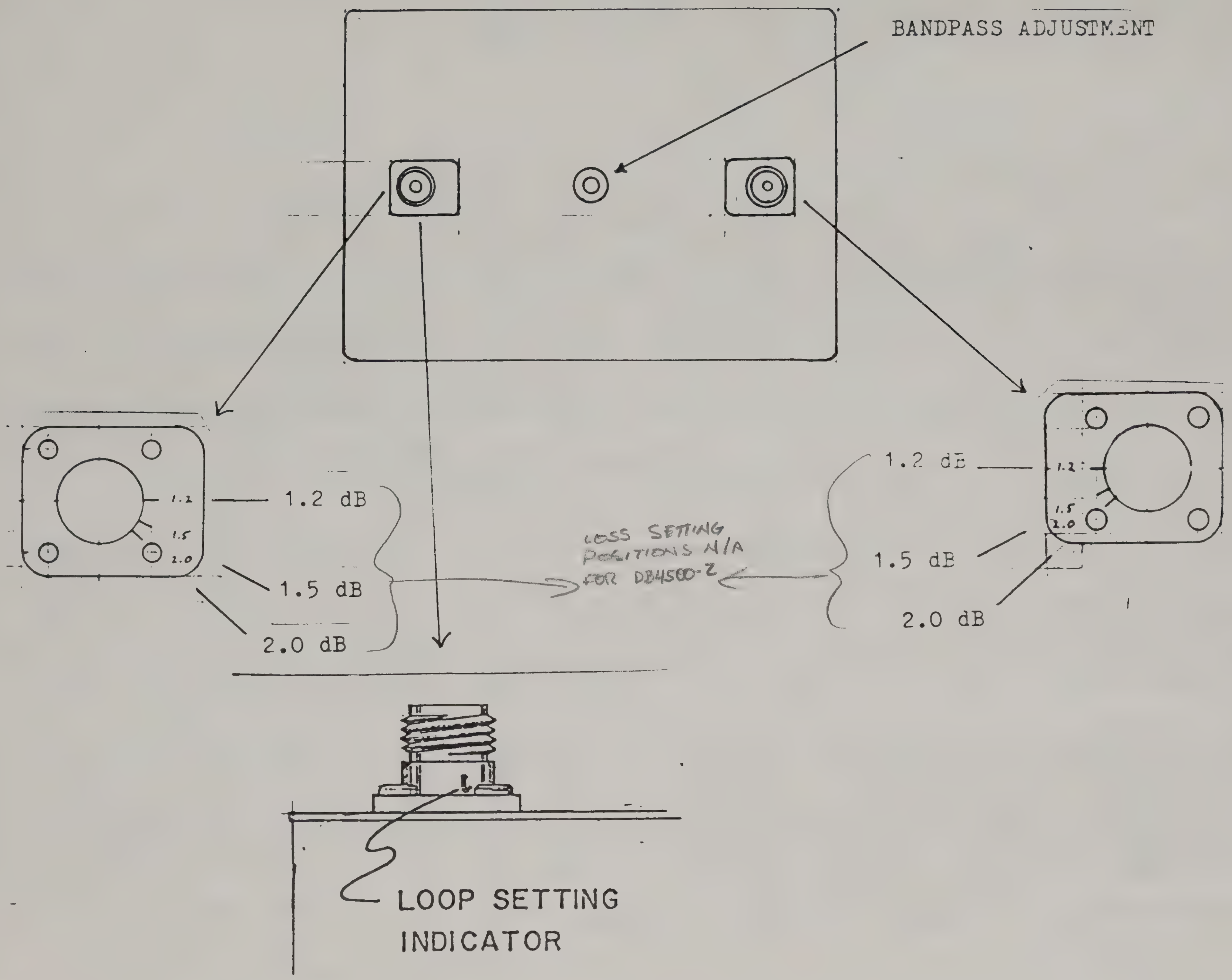
4. Set transmitter power to normal operating level and repeat step 3.

5. Reconnect equipment as shown in Figure 1 and repeat step 1, tuning capacitors 1 and 4 only.

6. Reconnect the equipment as shown in Figure 2 and repeat step 2 with full transmitter power.

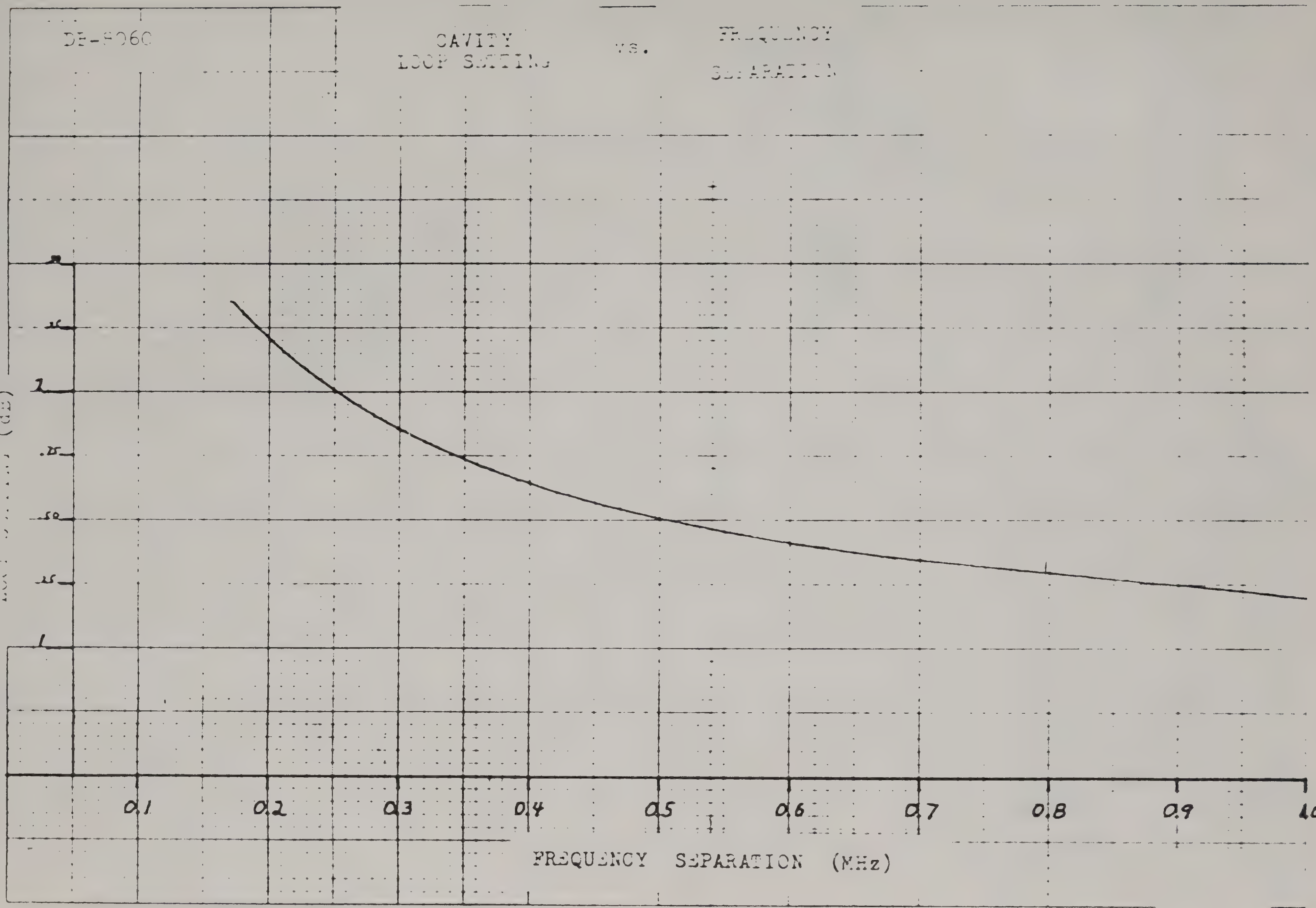
7. The isolator should now be ready for normal operation, and should get warm after several minutes of operation. Undue heat in the dummy load closest to the antenna (next to capacitor 6) is due to power reflected from the antenna, and could indicate a faulty antenna or transmission line.

INSERTION LO ADJUSTMENT



LOSS SETTING POSITIONS N/A FOR DB4500-Z

K+E TO THE INCH KEUFFEL & ESSER CO. 46 0782



DE-8060

CAVITY LOOP SETTING vs. FREQUENCY SEPARATION

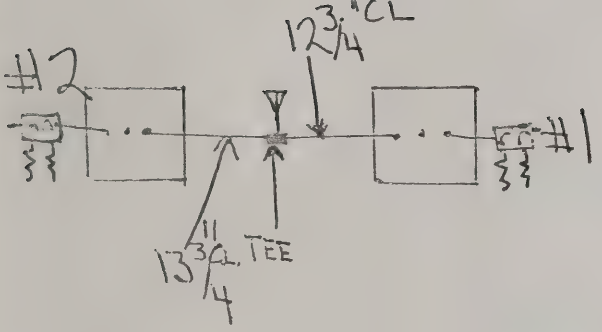
DB 4500-B2

DATE 3-14-86

BY TEST & TUNE 47

TX 1 925.8375

TX 2 931.6875



ISOLATION & INSERTION LOSS IN dB

PORT	1	2
1	-1.5	-85+
2	-85+	-1.6

NOTE: ENCIRCLED NUMBERS ARE INSERTI[illegible] VALUES [illegible]

DECIBEL PRODUCTS, INC.

DECIBEL PRODUCTS

DB8060 COMBINER

MANUAL

OCTOBER 1986

ANTENNA SYSTEMS PRODUCTS

P.O. BOX 47128 • 3184 QUEBEC ST. • DALLAS, TEXAS 75247
(214) 631-0310 • TELEX 73-0212

YOUR DECIBEL PRODUCTS
DB-8060 COMBINER

INTRODUCTION

SECTION I INSTALLATION INSTRUCTIONS

SECTION II TUNING INSTRUCTIONS

a. Minor Adjustments
(maximum in-maximum out)
b. Major Adjustments
(frequency changes or
expansion)

SECTION III COMBINER EXPANSION/ORDER INFORMATION

INTRODUCTION

The DB8060 series of trunk/conventional combiner features two or more (DB8060, Figure 1,2,3,4) channels phased to a single output. Channels can be added one(1) at a time or in groups up to ten(10) channels (DB8060-10, Figure 3) utilizing standard phasing harness. Expansion beyond ten(10) to up to twenty(20) channels (Figure 4) requires a five way "N" junction and phasing cables (Figure 4). A dual junction isolator (DB4642-2B, Figure 5) is provided with each channel to protect against transmitter intermodulation.

SECTION I (Installation Instructions)

A typical set-up for a DB8060-5 channel combiner (Figure 2) includes two each DB8060-2 channel panels and one each DB8060-1 channel panel all phased in series to a single output. Rack installation is accomplished with four(4) sheet metal screws per panel (total 12). Illustrative set-ups are shown in:

Figure 1: DB8060-2 (2 channel combiner)

Figure 2: DB8060-5 (5 channel combiner)

Figure 3: DB8060-10 (10 channel combiner)

Figure 4: DB8060-20 (20 channel combiner)

(A) 5-way "N" junction with shorted stub expands to eleven(11) channels.
(B) 5-way "N" junction with four(4) phasing cables expands eleventh (11th) and twelfth(12th) channels on through twenty(20) channels maximum capacity.

For initial installation or expansion, select the illustration that best matches the combiner to be installed. Arrange the paneled groups in the rack in the order of tuned frequency groups. Follow the "in series phasing" illustration for proper cable installation. When completed the combiner is ready for operation.

SECTION II Tuning Instructions

The combiners are factory-tuned to the exact frequencies specified and shipped ready for immediate installation. No further field tuning or adjustment is required. To check the performance of the combiner, refer to "Minor Adjustments" below.

If it becomes necessary to change the operating frequencies of the combiner, the procedure outlined below must be followed for optimum results. The "Major Adjustments" procedures are for individual channel tuning. If multiple channels require re-tuning, remove the "in series" phasing harness before proceeding. In laying out your frequency plan, however, remember that minimum frequency spacing is 250KHz between channels. Depending upon retuning requirements, follow the (a) "Minor Adjustments" procedure when frequency changes of less than + or -500KHz are required (b) "Major Adjustments" procedure when frequency changes of greater than + or -500KHz, or in case of readjustment of combiner when adding channels.

"Minor Adjustments" require two(2) wattmeters with appropriate range. Thus, minor adjustments are done under power. One(1) wattmeter at the channel input, one(1) wattmeter at the combiner output.

"Major Adjustments" (complete readjustment of combiner frequencies) requires the use of equipment such as spectrum analyzer with tracking generator or an R-2001 model spectrum analyzer used with the internal duplex generator function, or network analyzer or equivalent sweep equipment. (See illustration A and B.)

Minor Adjustments

Equipment: Two(2) wattmeters with appropriate range.

Procedure Steps:

1. Reduce the output power from the transmitter connected to the port that requires adjustment to 10 watts to prevent damage to the transmitter or combiner components caused by excessive reflected power.

2. Connect a wattmeter to the antenna output of the combiner.

3. Locate the 1/4 in. threaded rod for the channel to be adjusted. (See Figure 5) Remove tension on "locknut" Adjust the tune-rod for maximum output power as indicated on the wattmeter.

4. Adjust the transmitter for rated power and repeak the channel tune-rod for maximum output power. Apply torque tension to the "locknut" associated with the tune-rod.

5. If the combiner uses tunable isolators, adjust capacitors #1,2,3 and 4 for maximum power on the wattmeter. (see Figure 5)

6. Check for insertion loss by measuring first the input power and then the output power. For 5 channel combiners with 1.0 MHz frequency separations the per channel loss should not exceed -2.2dB, for a 10 channel combiner, the loss should not exceed 3.2dB per channel. Minor adjustments should be performed when channel losses exceed these levels. The insertion loss can be computed with the formula dB loss = 10 log (power in/power out) or by using the attached Table A. In using the table, locate the power input to the channel on the chart and note the DBW value corresponding to the power level. Next, locate the power output of the channel on the chart, again, note the DBW value. The difference between the two is the insertion loss.

Major Adjustments

The following procedure is to be used for complete readjustment of the combiner when adding frequencies or when new frequencies require changing the tuning beyond + or -500KHz. Example: 5-channel combiner with 1MHz between channels - Figure 2 shows channel 1 through 5 show frequency assignments (F1=lowest frequency F5=highest frequency). 10 channel combiner with 500KHz between channels: Figure 3 shows F1=lowest frequency F10=highest frequency. These channel frequency assignments should be followed for optimum results.

This procedure requires a spectrum analyzer with a tracking generator or a R-2001 spectrum analyzer used with the internal duplex generator function. Network analyzer or equivalent sweep equipment. (see illustration A and B.)

The recommended procedure is as follows:

1. It is not necessary to shut down all transmitters for tuning purposes. Only the group of "in series" combined channels that is to be re-tuned. Example: if 10 channels are to be re-tuned, the "in-series" groups of 5 channels either side of the "phasing harness" can be "shut down" one group at a time for re-tuning purposes. However, a "shorted stub" should be placed in the phasing harness while that group is being re-tuned. The same procedure may be used for 20 channel combiner re-tuning. As the 4 separate groups of 5 channels are being returned, place the "shorted stub" in the 5-way in junction to the port that phased the channels to be tuned.

2. Disconnect the "in series" phasing cables and the tee connector from each cavity in the group.

3. Tune test equipment to the desired frequency.

4. Connect signal input lead to isolator and detector lead to cavity output connector.

5. Locate the 1/4" threaded tune-rod (on the cavity) for the channel to be re-tuned (clockwise lowers the frequency). (See Figure 5) Remove torque tension on "locknut". Adjust cavity to proper frequency;, adjust isolator for minimum pass loss on resonant frequency. (see isolator tuning instructions)

6. Reverse test leads and tune isolator (capacitors 5 and 6, See Figure 5) for maximum attenuation.

7. Repeat step 5. Retorque tension on locknut.

8. Repeat the above procedures for all the remaining channels.

9. Reconnect all channels to their original phased configuration.

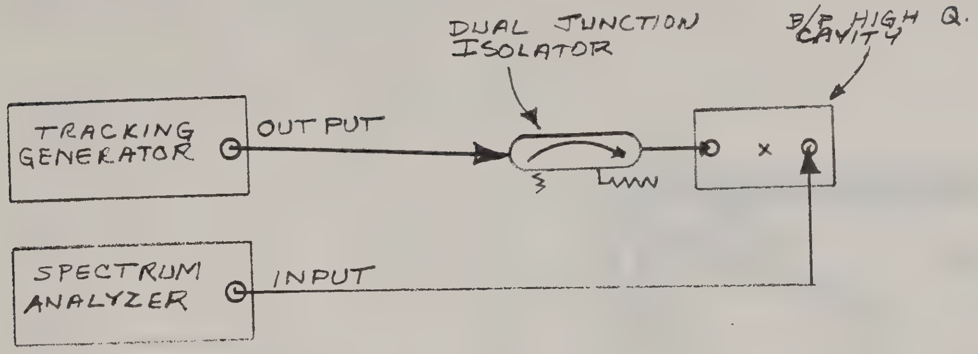
10. Repeat step 5 to all channels detecting at the antenna terminal.

11. Due to interaction between channels, step 10 may have to be repeated.

12. The tuned portion of the combiner should now be ready for operation.

(Illustration A)

"Major Adjustments"
Spectrum Analyzer/Tracking Generator



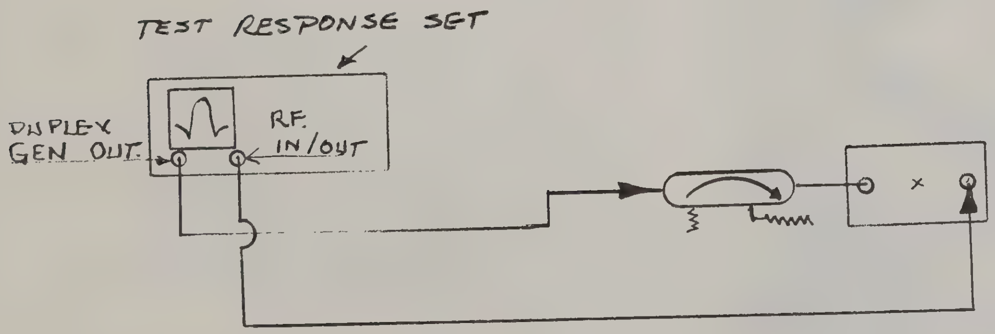
(A) Use illustration for minimum "pass loss" tuning. Capacitors number 1,2,3, and 4 on isolator and 1/4" threaded tuning rod on B/P cavity.

(B) For maximum attenuation (reverse isolation) through isolator, reverse leads and tune capacitors number 5 and 6.

==

(Illustration B)

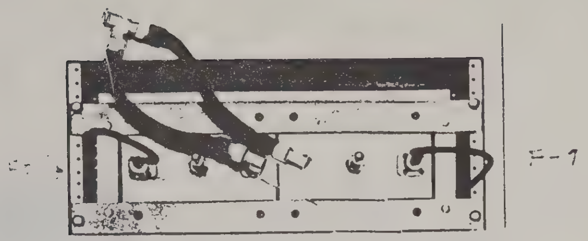
Network Analyzer/Spectrum Analyzer with Duplex Generator



Note: Follow same tuning procedures (A) and (B)

(Figure 1)

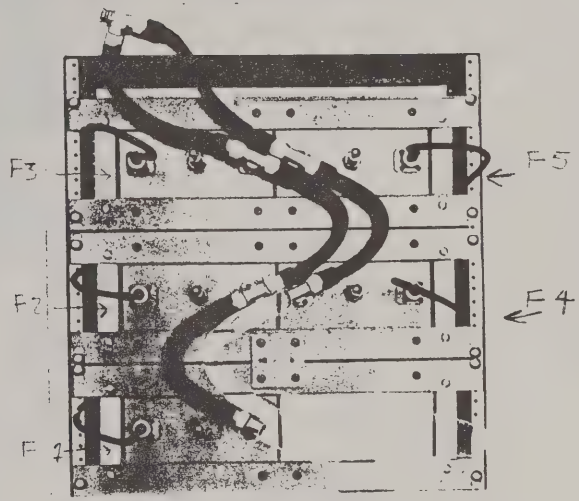
Note: Can be expanded with
8 more channels
up to 10 channels
with phasing harness
supplied.



DB 8060-2 CHANNEL

(Figure 2)

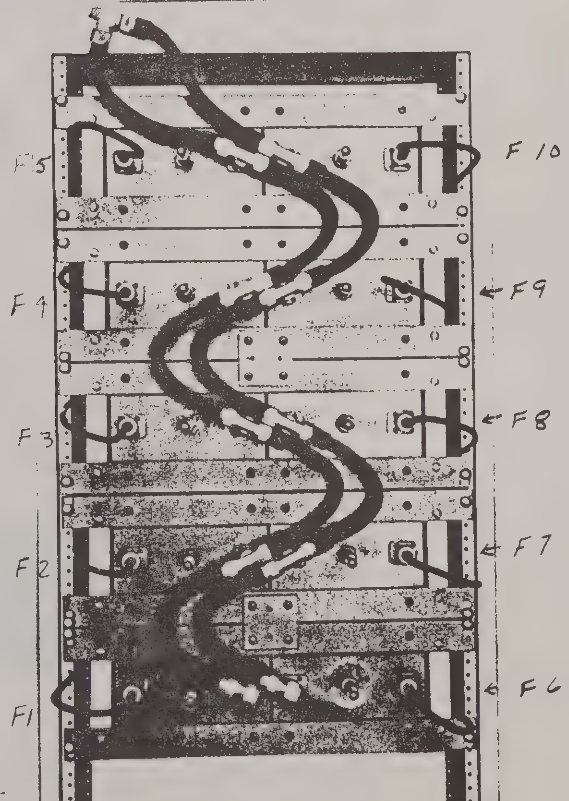
Note: Can be expanded
5 more channels
up to 10 channels
with phasing harness
supplied.



DB 8060-5 CHANNEL

(Figure 3)

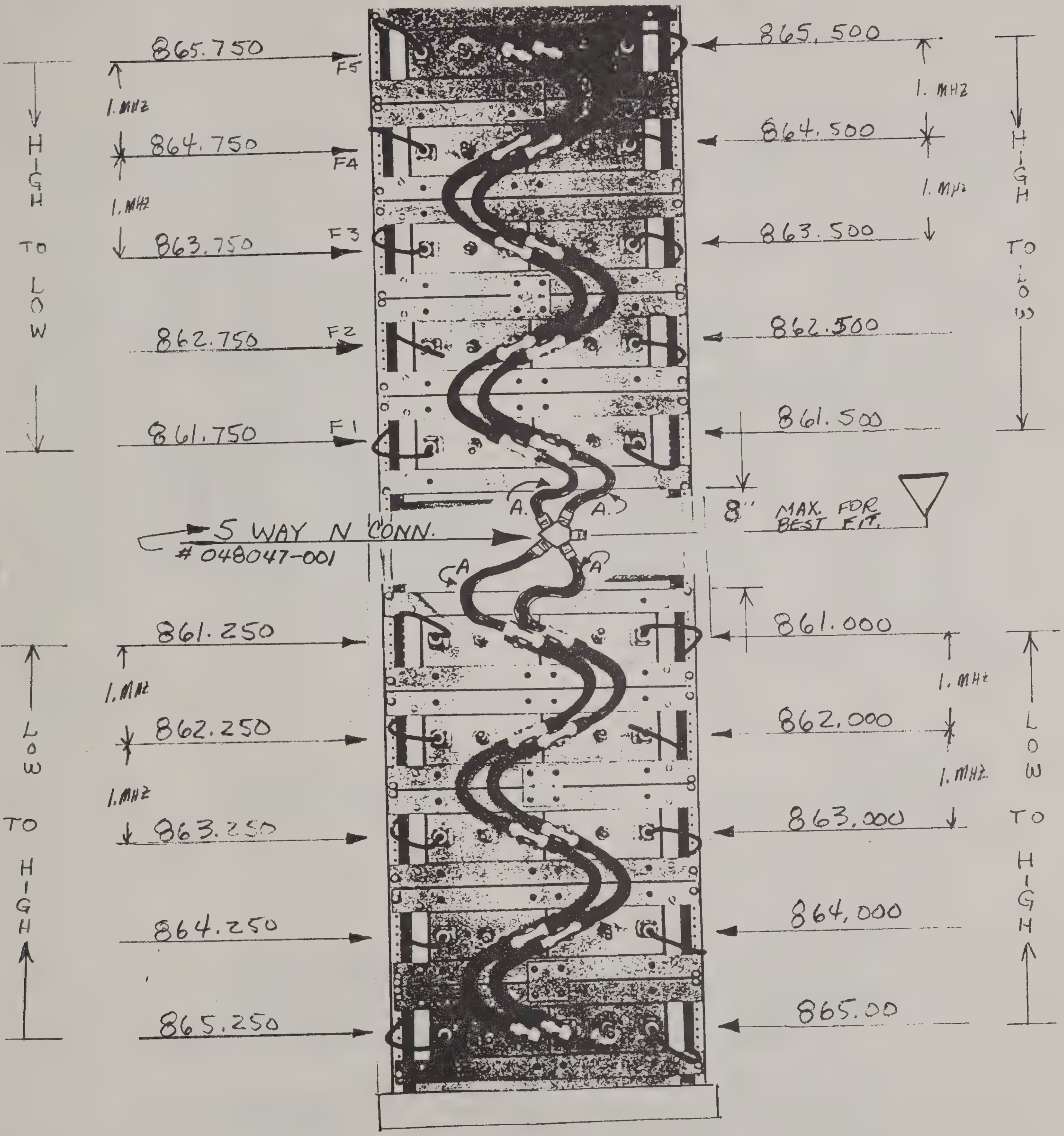
Note: 10 channels illustrated
to maximum channel
capacity with phasing
harness supplied. For
expanding 11 through 20
channels see (Figure 4)
requires "N"-way junction
and phasing cables for
further expansion.



DB8060-10 CHANNEL

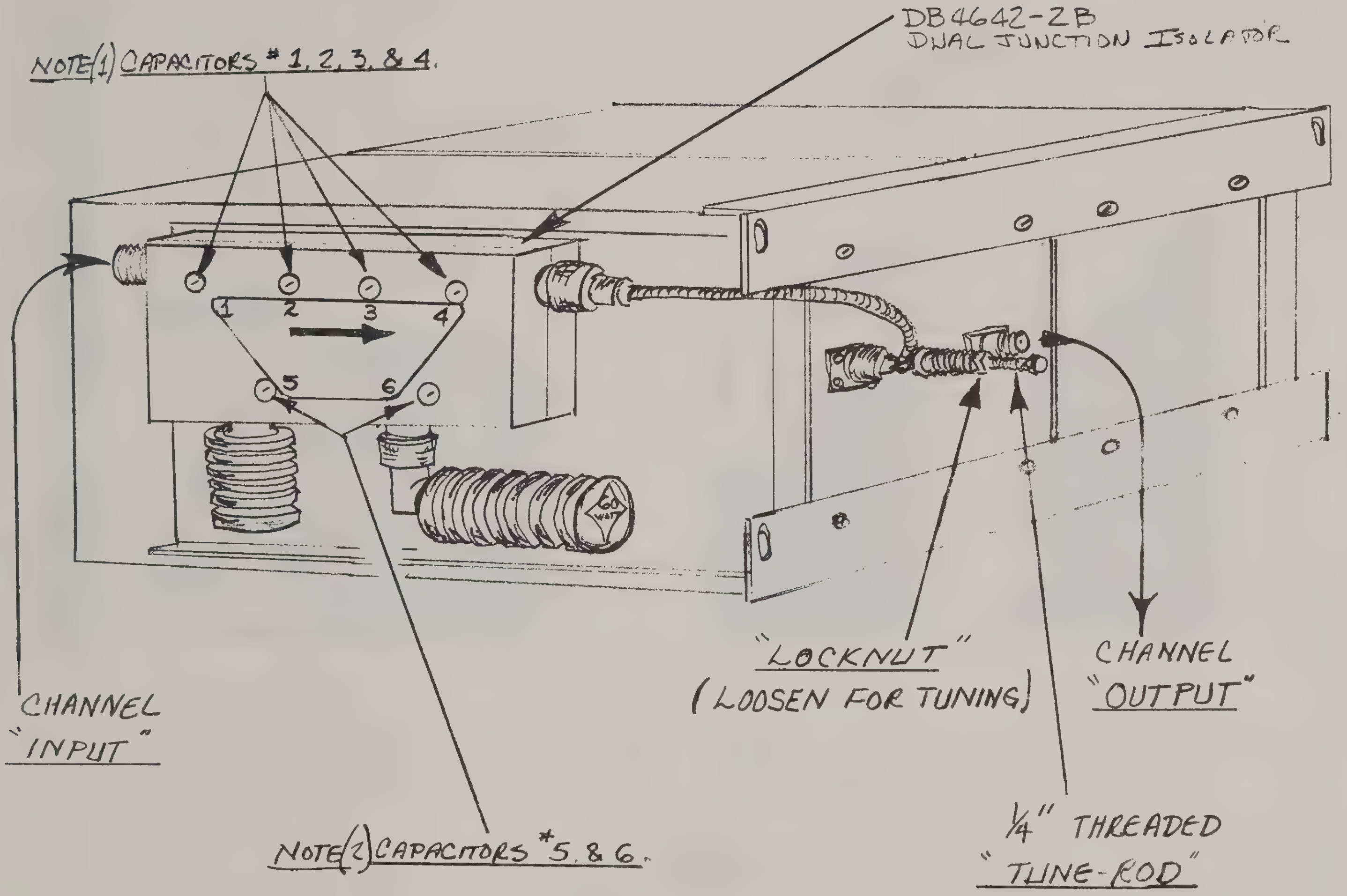
(Figure 4)
DB8060-20-A
#1 Min 250KHz Tx to Tx
#2 All Channels Trunked
#3 855MHz-866MHz Band

Example: Suggested Channel Frequency Assignments



(A) Phase Cables 8-3/4" C.L (#054004-109) 4 ea.

(FIGURE 5)
ILLUSTRATION DB8060-1 CHANNEL



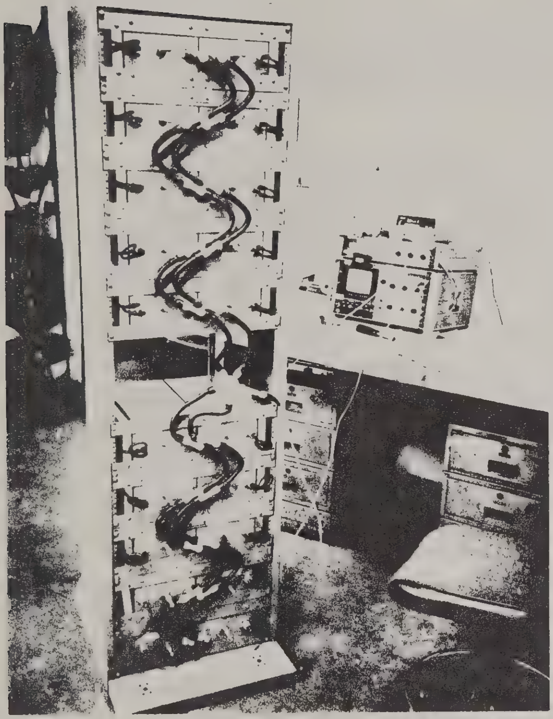
Note(1) Variable capacitors 1, 2, 3 and 4 are adjusted for "maximum outpout power" (minimum loss) on the channel "pass" frequency. (Clockwise rotation lowers the pass band).

Note(2) Variable capacitors 5 and 6 are adjusted for "maximum attenuation" (reverse isolation) on the channel frequency. (Clockwise rotation lowers the maximum attenuation band).

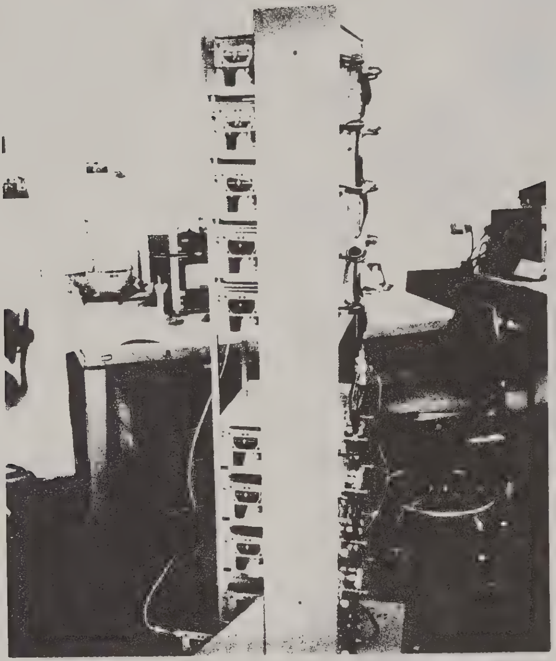
SECTION III.

DB8060-20A
TRUNKING COMBINER
855 MHZ - 866 MHZ BAND

FRONT VIEW



SIDE VIEW



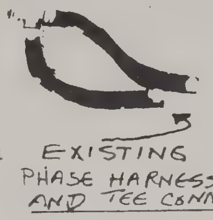
MOUNTED IN STANDARD (6ft. x 19 in. open rack)
(DB# = DB70 rack)

QTY	MATERIALS	ORDERING PART NUMBERS	DESCRIPTION
20	DB-4642-2B	DB-4642-2B	Dual Junction Isolator
20	5"x7" 3/4 Wave	040258-005	Copper Cavities (Bandpass)
20	18"x1/4" Superflex	054002-257	Interconnect (Isolator Out-to-cav. in)
16	8-3/4"x1/2"superflex	054004-109	Interconnect (Cav. to cav. in series)
4	8-3/4"x1/2" Superflex	054004-109	Phasing cables (to 5-way in conn)
1	5-Way-N-Junction	048047-001	20 Channel Coupling Conn.
16	UG 107 Connector	031010-014	N-female-N-female-N-male "T" conn.
4	UG 27 Angle Conn.	031010-011	N-female-N-male right-angle conn.
1	DB70 Rack	DB-70-RACK	6 ft. x 19" open rack

Note: Hardwares, braces and brackets are not listed.
Minimum frequency separation 250 KHz.

INSTRUCTIONS FOR EXPANDING DB8060-10 INTO DB8060-11 THROUGH DB8060-20

Notes: Assuming the existing DB8060-10 is presently mounted in the "top" of the 19" rack and expansion to 11, or 11 and 12 through 20 channels are required. The following changes are required.



Requirements

1. Remove existing phase harness and "N" tee connector. (Existing 10 ch combiner)

2. Remove tee connectors (UG-107) from 2 "top" channels. Remove right angle "elbow" connectors (UG-27) from 2 bottom channels.

3. Attach the elbow connectors (UG-27) to 2 "top" channels. Attach the "tee" connectors (UG-107) to the 2 "bottom" channels. Connect the interconnecting cables to the relocated connectors. (See top 10 channels as shown in illustration)

4. When expanding to 11 or 12 channels locate mounting brackets in the rack a minimum of 8" spacing between "top" 10 channels.

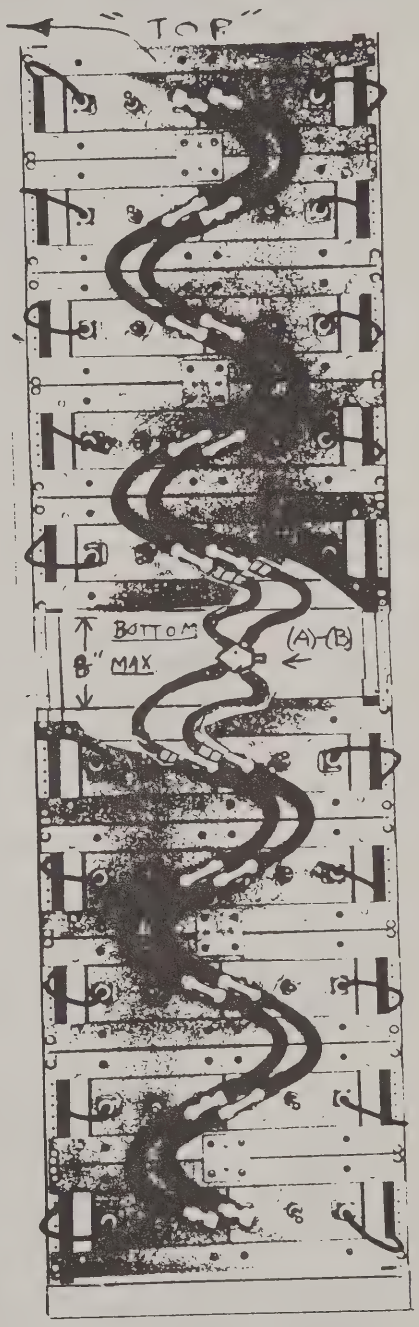
5. When expanding to 11 channels only use 5-way "N" junction and 3 phasing cables with unused port termination with shorted stub. (illustration A)

6. When expanding to 11 and 12 channels or more, use 5-way "N" junction and 4 phasing cables. (illustration B)

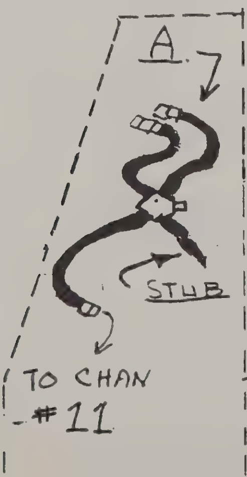
Summary

Minimum frequency separation = 250 KHz
Maximum channel capacity = 20 channels

DB-8060 SERIES



DB-70 OPEN RACK
6 FT X 19" SPACE.



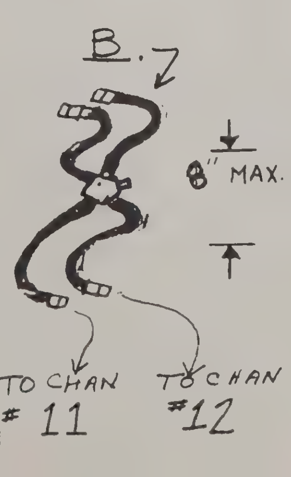
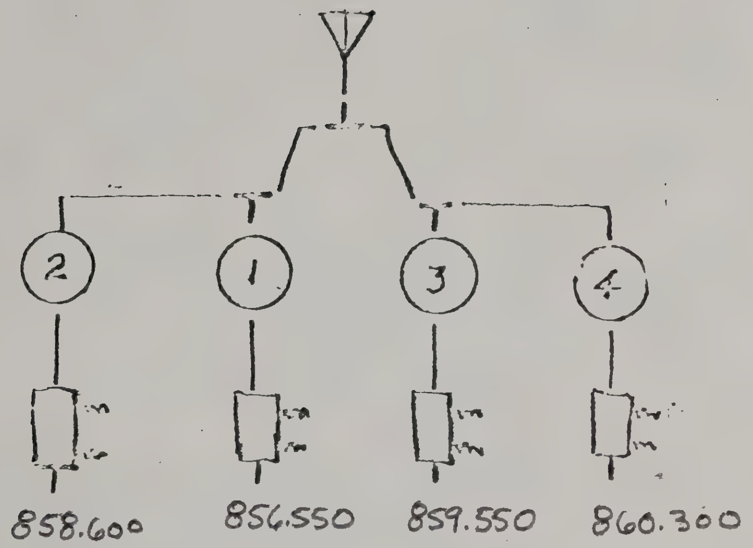


TABLE A
WATTS TO DBW CONVERSION TABLE

WATTS	DBW	WATTS	DBW	WATTS	DBW	WATTS	DBW
1	0.0	41	16.1	82	19.1	164	22.1
2	3.0	42	16.2	84	19.2	168	22.3
3	4.8	43	16.3	86	19.3	172	22.4
4	6.0	44	16.4	88	19.4	176	22.5
5	7.0	45	16.5	90	19.5	180	22.6
6	7.8	46	16.6	92	19.6	184	22.6
7	8.5	47	16.7	94	19.7	188	22.7
8	9.0	48	16.8	96	19.8	192	22.8
9	9.5	49	16.9	98	19.9	196	22.9
10	10.0	50	17.0	100	20.0	200	23.0
11	10.4	51	17.1	102	20.1	204	23.1
12	10.8	52	17.2	104	20.2	208	23.2
13	11.1	53	17.2	106	20.3	212	23.3
14	11.5	54	17.3	108	20.3	216	23.3
15	11.8	55	17.4	110	20.4	220	23.4
16	12.0	56	17.5	112	20.5	224	23.5
17	12.3	57	17.6	114	20.6	228	23.6
18	12.6	58	17.6	116	20.6	232	23.7
19	12.8	59	17.7	118	20.7	236	23.7
20	13.0	60	17.8	120	20.8	240	23.8
21	13.2	61	17.9	122	20.9	244	23.9
22	13.4	62	17.9	124	20.9	248	23.9
23	13.6	63	18.0	126	21.0	252	24.0
24	13.8	64	18.1	128	21.1	256	24.1
25	14.0	65	18.1	130	21.1	260	24.1
26	14.1	66	18.2	132	21.2	264	24.2
27	14.3	67	18.3	134	21.3	268	24.3
28	14.5	68	18.3	136	21.3	272	24.3
29	14.6	69	18.4	138	21.4	276	24.4
30	14.8	70	18.5	140	21.5	280	24.5
31	14.9	71	18.5	142	21.5	284	24.5
32	15.1	72	18.6	144	21.6	288	24.6
33	15.2	73	18.6	146	21.6	292	24.7
34	15.3	74	18.7	148	21.7	296	24.7
35	15.4	75	18.8	150	21.8	300	24.8
36	15.6	76	18.8	152	21.8	304	24.8
37	15.7	77	18.9	154	21.9	308	24.9
38	15.8	78	18.9	156	21.9	312	24.9
39	15.9	79	19.0	158	22.0	316	25.0
40	16.0	80	19.0	160	22.0	320	25.1

QUIGLEY Comm.
MODEL SP 7366-4
SN # D 83688
DATE 11-13-84
BY

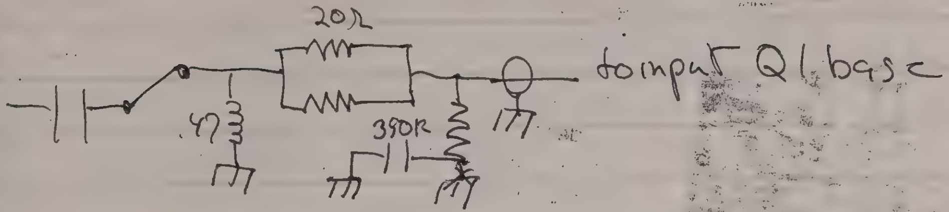
TESTED
40

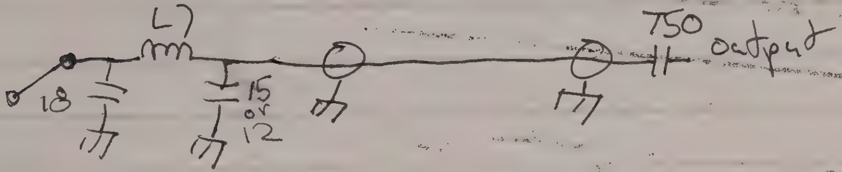


ISOLATION & INSERTION LOSS IN dB

PORT	1	2	3	4
1	-1.8 f=	-80^+ f=	-80^+ f=	-80^+ f=
2	-80^+ f=	-2.0 f=	-80^+ f=	-80^+ F=
3	-80^+ f=	-80^+ f=	-2.1 f=	-80^+ f=
4	-80^+ f=	-80^+ f=	-80^+ f=	-1.8 f=

red blk blk red wht

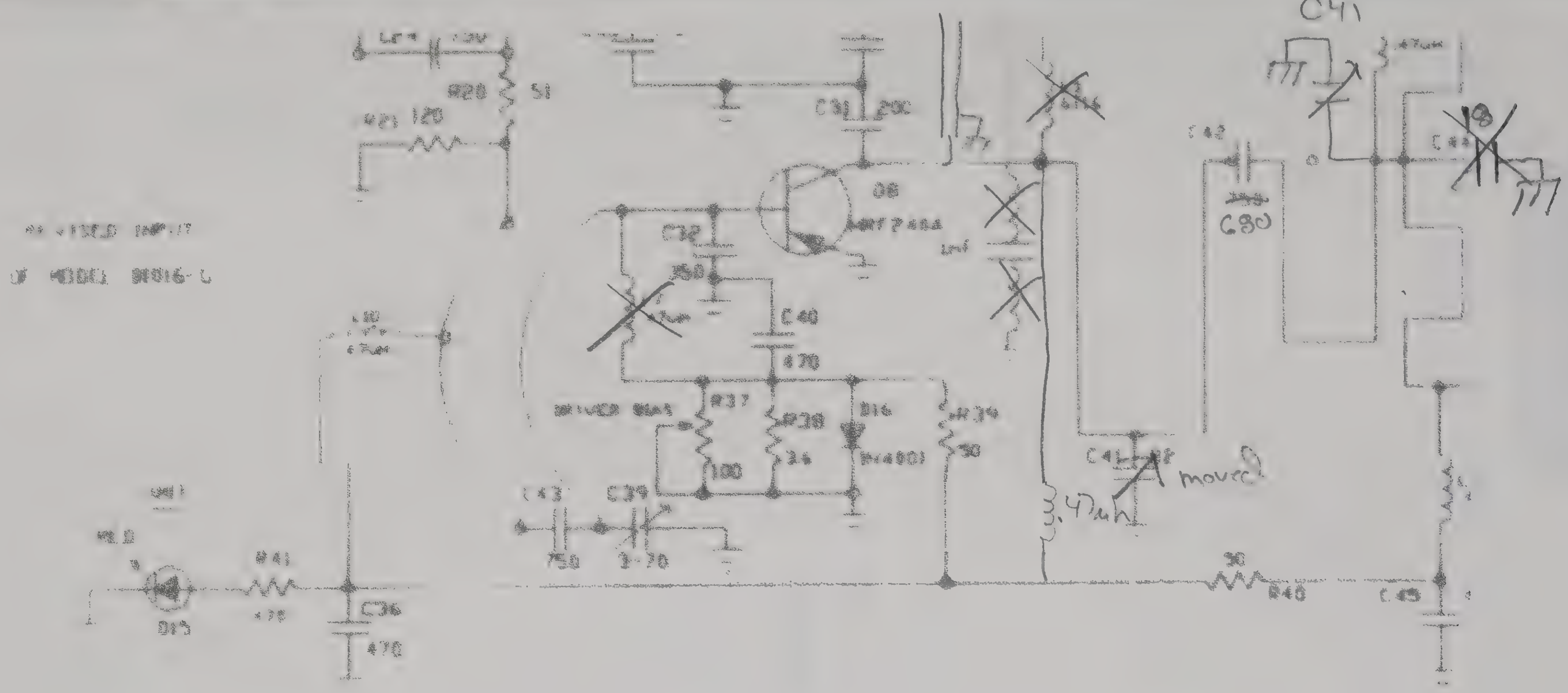




Mirage 300 Industrial Rd
Starkville MS 39759
601-323-8287

100ma per final x2 = 200ma
100ma driver
B1016G D1010N
Melvin 1046-96 0712

KLM 2M-22C ~~Ab~~
435-40CX Carolyn
360 ~~306~~-794-~~0294~~ 2923


C41
C42
680
R28
51
R21
120
C31
200
Q8
C32
350
C40
470
DRIVER BIAS
R37
100
R38
24
D16
R39
50
C43
750
C39
3-70
R41
C36
470
D15
47uh
moved
50
R40
C45

MIRAGE
COMMUNICATIONS EQUIPMENT

D1010-N
430 - 450 MHz
AMPLIFIER

D1010-N

The MIRAGE D1010N represents the latest in 430 to 450 MHz Power Amplifiers. It incorporates features that make it the most versatile and useful amplifier available today. The D1010N will amplify FM, SSB, and CW signals. It has variable SSB delay, remote keying, over-temperature protection, and remote control operation when using the optional RC-1, Remote.

SPECIFICATIONS

FREQUENCY RANGE	430 TO 450 MHz
POWER.	INPUT: 3-15 Watts OUTPUT: Min of 100 W with 10 W in
MODES	FM, SSB, CW, ATV with modifications
DC POWER	13.6 VDC at 20 amps nominal
FUSE	35 amp (internally mounted)
IMPEDANCE	50 Ohm input and output
DUTY CYCLE	Intermittent-internal overtemp
SIZE	12" X 3" X 5-1/2"
Weight	5 LBS.

INSTALLATION

The D1010N may be mounted by using the brackets supplied. The D1010N must have adequate ventilation around the heat sink. Use of # 8 or larger wire to connect the D1010N to the battery is recommended. RG-8U or the equivalent should be used between the D1010N and the antenna. The antenna should be matched, to better than 1.5:1 for best performance.SWR greater than 3:1 may cause damage to the amplifier voiding any warranty.

FRONT PANEL FUNCTIONS

POWER-ON/OFF	This switch turns the power amplifier ON and OFF
SSB/FM	Selects the relay time delay for the mode of operation. In either the SSB or FM position, the amplifer is still biased for linear operation.
LED (Power On)	This LED will go out if the amplifier overheats. It will come back on when the amplifier has cooled.
LED (TX)	This LED will light during transmitting periods

REAR PANEL FUNCTIONS

"RADIO"	This connects to the transmitter or transceiver.
"ANT"	This connects to the antenna.
RCA JACK	This connector can be used to ground key the transmit relay if the input signal is too weak to activate the RF sensing circuit which normally handles the function.
6 PIN CONNECTOR	The RC-1 Remote Control Head connects here.

PRECAUTIONS:

OUTPUT POWER	The D1010N puts out enough power to cause heating of the coax. RG-8 or equivalent is recommended between the amplifer and the antenna.
HEAT SINK TEMPERATURE	Along with high-power output comes the posibility of high heat sink temperatures. The D1010N must be mounted where air can circulate over the heat sink. The D1010N has a built-in thermostat that will turn it "OFF " at 170 F. The amplifier will not come back on until the temperature drops to 140 F.
INPUT POWER	Input power should not exceed 15 Watts. Higher power than this may cause failure of the input transistor . This will VOID ANY WARRANTY.
SSB OPERATION	The D1010N can be overdriven, causing the SSB signal to be distorted. When using the D1010N on SSB, the drive level or the mike gain from the exciter should be adjusted for best "on the air" performance.

INTERNAL ADJUSTMENTS

"SSB DELAY"	This allows XMT relay delay time to be adjusted various lengths. Access to this adjustment is through the hole in the left side of the cover, behind the front panel. A small screwdriver can be used to make this adjustment.
"RF ADJUSTMENTS"	There are no internal adjustments dealing with the RF amplifier board. The tuning of the RF amplifier is preset at the factory by our technicians.

FUSE	A 35 AMP fuse is located under the the cover on the PC Board. Should the fuse "blow" determine the cause, and use exact type in unit as replacement.
"ATV MOD"	Remove .1 mfd disc cap and 10 ohm resistor which crosses over both final power transistors and connects each base to its collector lead. These cap/resistor networks are designed to eliminate low frequency oscilations and will distort ATV signals.

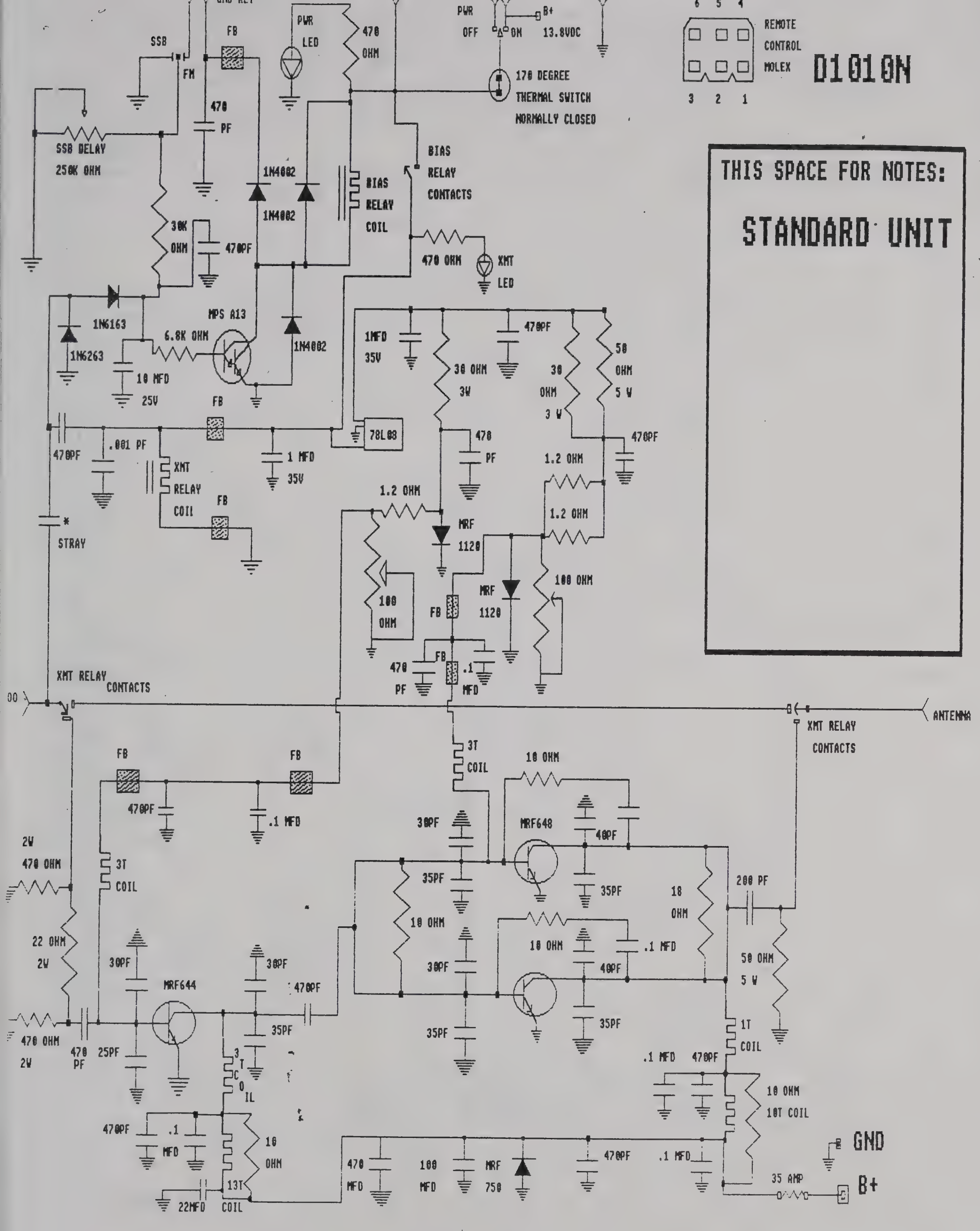
IN CASE OF DIFFICULTY

1. Check for loose antenna or B+ connections
2. Check SWR of antenna.
3. Look for bad or lossy co-ax.

IMPORTANT REMINDER

All MIRAGE/klm amplifiers manufactured for amateur radio-with the exception of repeater amplifiers - are rated as ICAS-Intermittent Commercial and Amateur Service. This generally means 5 minute duty cycles, i.e. 5 minutes transmitting, 5 minutes receiving.

Although all of our units except the hand helds have thermal protection, continued use where this cut out occurs can damage transistors.



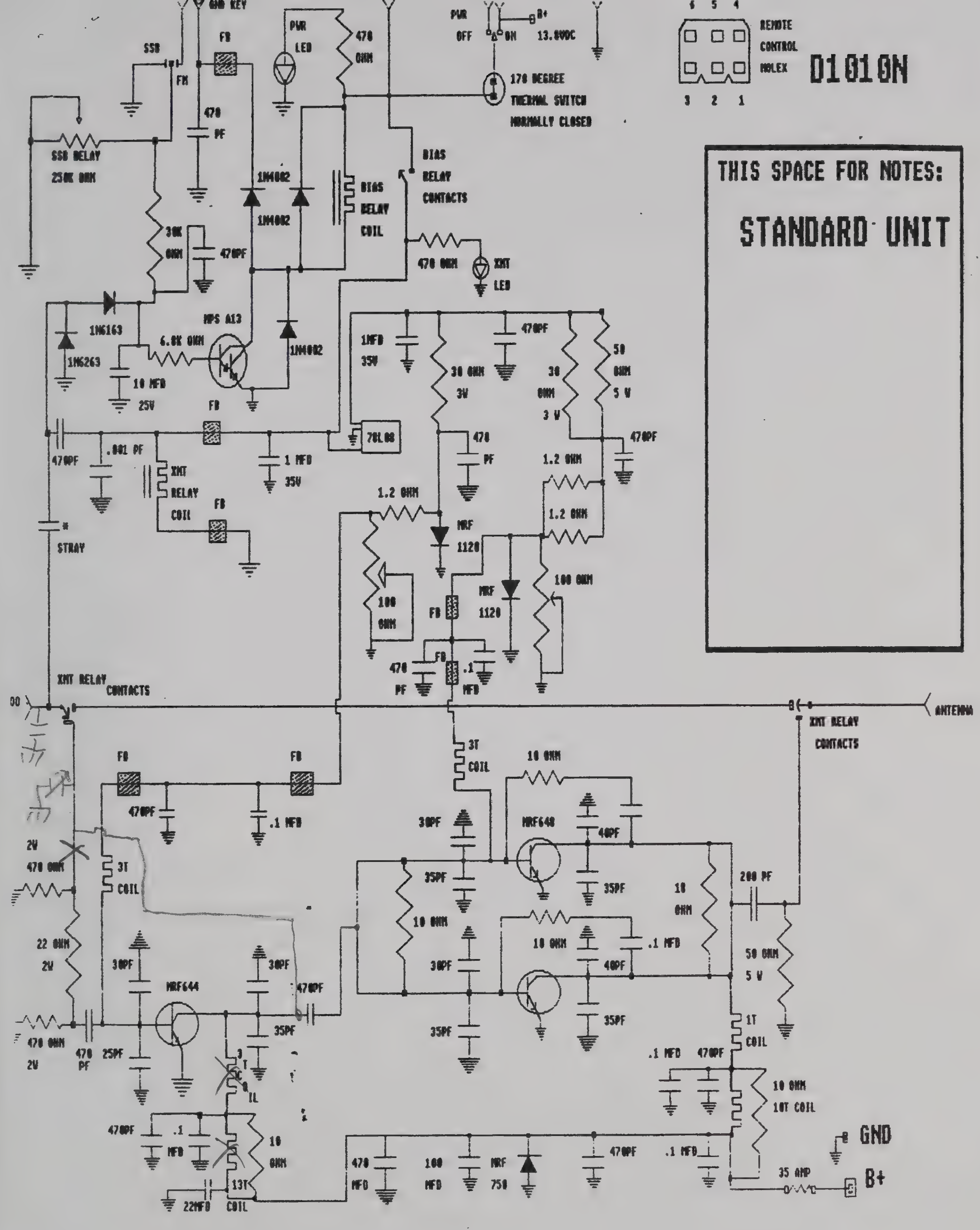
D1010N

THIS SPACE FOR NOTES:

STANDARD UNIT

3-20-90

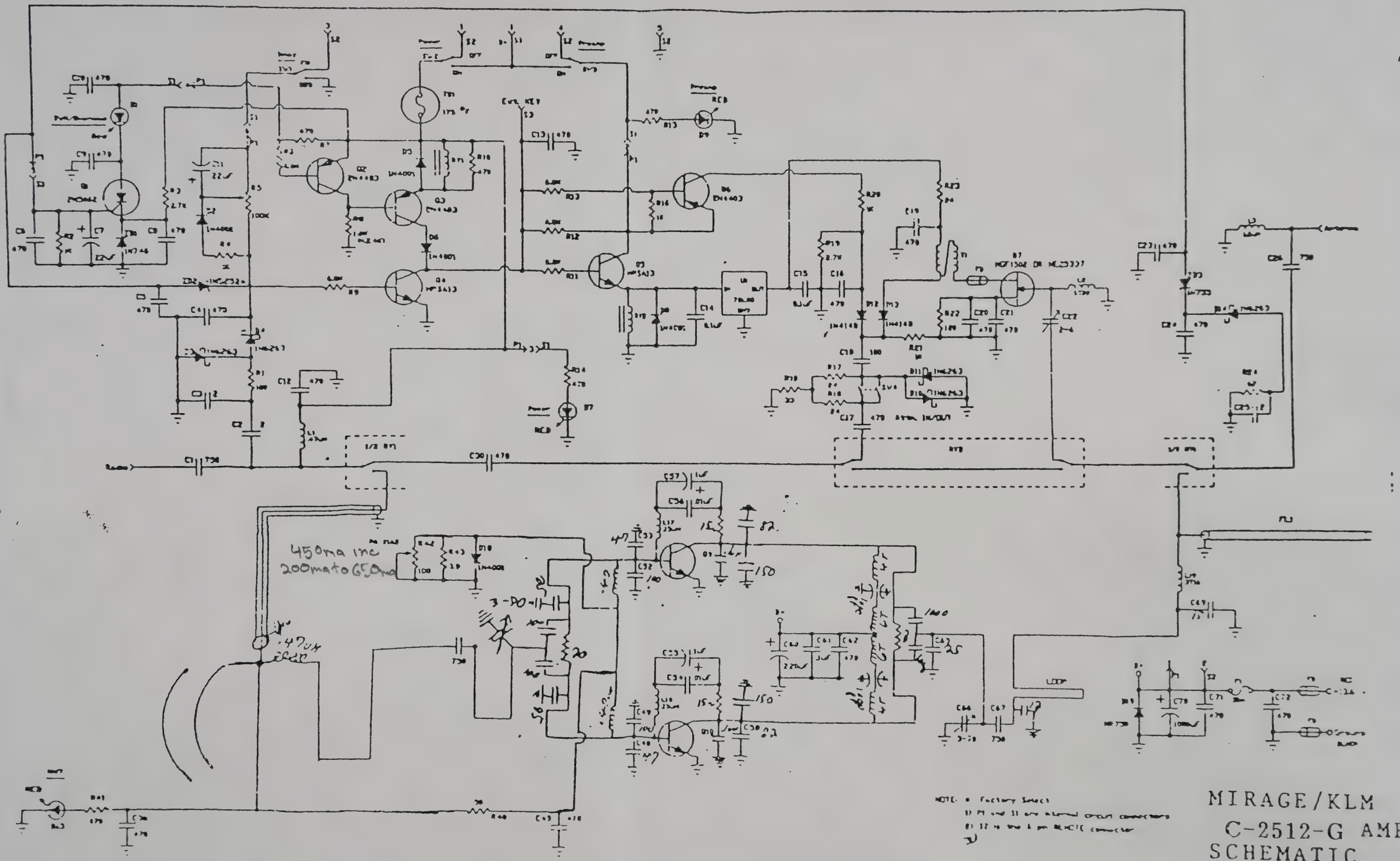
D1010N



THIS SPACE FOR NOTES:

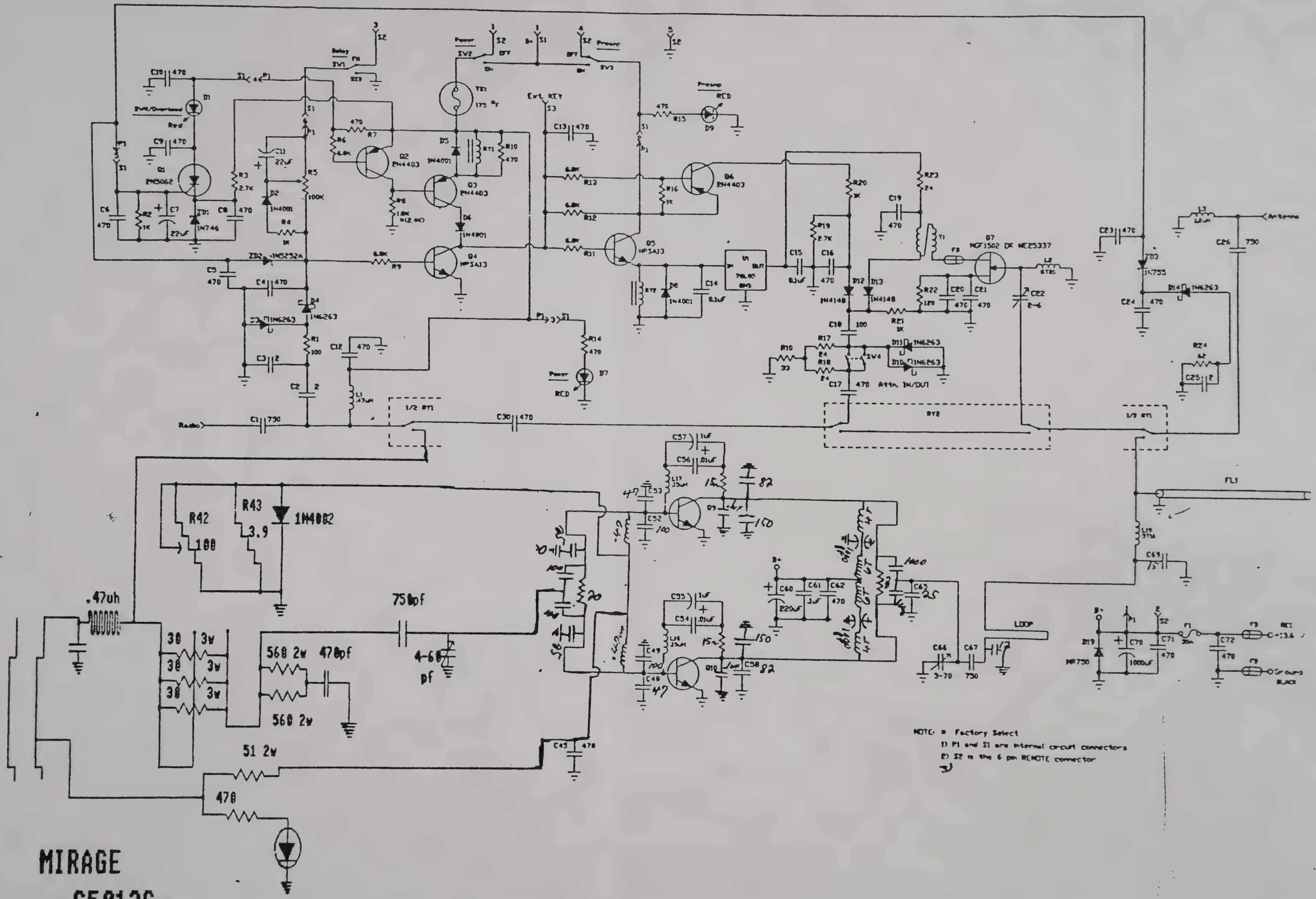
STANDARD UNIT

3-20-90



NOTE: * Factory Select
1) P1 and J1 are internal circuit connections
2) J2 is the 6 pin [illegible] connector
3)

MIRAGE/KLM
C-2512-G AMPLIFIER SCHEMATIC



NOTE: * Factory Select

1) P1 and S1 are internal circuit connectors

2) S2 is the 6 pin REMOTE connector

3)

MIRAGE

C5012G

4-16-90

CELWAVE

INSTRUCTION MANUAL
MODEL NO. TJC-800-4
SERIAL NO. 7-01400-A

115 EAST WATKINS PHOENIX, ARIZONA 85004
TEL.: (602) 252-8058 TWX: 910-951-4220

LIMITED WARRANTY

The Seller warrants that, at time of shipment, the products manufactured by the Seller are free from defects in material and workmanship. The Seller's obligation under this warranty is limited to replacement or repair of such products within one year from the date of shipment. No material is accepted for replacement or repair without written authority of the Seller. Replacement or repair is made only after an examination at the Seller's plant shows defective material or workmanship at the time of manufacture. All shipping charges on the returned material must be prepaid by the Buyer.

Seller is in no event liable for consequential damages, installation cost or other costs of any nature as a result of the use of the products manufactured by the Seller, whether used in accordance with instructions or not. The Seller is not liable for replacement of any antenna damaged by lightning.

This warranty is in lieu of all others, either expressed or implied. No representative is authorized to assume for the Seller any other liability in connection with the Seller's products.

CELWAVE
Route 79, Marlboro, NJ 07746 • Tel. (201) 462-1880 • TWX (710) 722-3661
P.O. Box 389 Route 44, Leesburg, FL 32748 • Tel. (904) 787-9200 • TWX (810) 871-0873
HMP Antennefabrik APS Frejasvej 30 DK-3400, Hillerod, Denmark • Tel (02) 26 36 36 • TWX 42164 HMP • Cable HMPCOMAN
115 E. Watkins St. 85004 • Tel (602) 252-8058 • TWX 910-951-4220 PDCC PHX

CELWAVE

Celwave RF Inc.
115 E. Watkins Street
Phoenix, AZ 85004
Telephone (602) 252-8058

TJ OR JUNCTION SERIES TRANSMITTER COMBINERS

Description

The TJ series of transmitter combiners employ a combination of ferrite isolators and cavity resonators to obtain low insertion loss and high isolation between transmitters. Models having up to three isolators per channel and up to five channels are available in the 150, 460 and 800 MHz bands. The minimum channel spacing at which these units are used is 120 KHz at 150 MHz, 250 KHz at 460 MHz and 500 KHz at 800 MHz. In general a 5 channel unit at these minimum recommended spacings will have only slightly more than 3 db loss per channel. A data sheet for the particular unit ordered is included with this pamphlet. This sheet gives all the insertion losses, isolations and VSWR's of the combiner when operated into an ideal 50 Ohm load. If the unit is ordered with an option such as power monitoring, then instructions for that option will be appended to these instructions.

Installation (General)

After unpacking the unit, the installer should determine where the input and output ports of the combiner are and to make sure that the various transmitters will be connected to their correct terminals The antenna terminal is marked ANT and the input terminals are numbered T1, T2, etc., generally in ascending frequency order. The data sheet for the unit being installed will show the installer which transmitter should be connected to each of the input terminals. The cables used to connect the transmitters to the combiner should be of the double shielded type to avoid undesired coupling. The unit should be operated initially into a 50 Ohm load to make certain that the delivered unit insertion losses are the same as those measured at the factory. Refer to Figure 1 attached for the following instructions.

Initial Testing

Figure 1 shows a 5 channel combiner in schematic form. The input terminals are marked test point "A", the outputs of the isolators are marked test point "B" and the antenna junction is marked test point "C". In addition a matching network is shown which is standard equipment with these junction combiners. This matching

network will be required when the antenna system VSWR exceeds 1.3 to 1 anywhere within the band required by all the transmitters. Its adjustment will be described under "Antenna System Matching".

To make power input versus power output measurements to check the insertion losses of the combiner the following is needed:

a. One (1) Bird Model 43 (or equivalent) through line power meter with type "N" connectors, and a plug-in for the appropriate frequency and power level.

b. One (1) 12" measured pin-to-pin length of RG-214 or equivalent with type "N" male connectors attached.

c. Two (2) 4' lengths of RG-214 with Male "N" connectors.

d. One (1) Type "N" double female connector.

e. One (1) 50 Ohm load with 100W or more rating.

Proceed as follows to obtain input and output power readings:

Step 1

Connect the 50 Ohm termination to the output or antenna terminal, test point "C", of the combiner through one of the 4' lengths of RG-214 cable.

Step 2

Connect the Channel 1 transmitter to the connector on the power meter and the other end of the power meter, via the 12" cable, to input terminal 1 (T1) on the combiner.

Step 3

Key the Channel 1 transmitter and note and record the forward power reading on the watt meter.

Step 4

Disconnect the wattmeter from the T1 terminal and connect it, via the 12" lead, to the"ANT" terminal. Connect the 50 Ohm load to the other terminal of the wattmeter, via the 4' cable. Connect the Channel 1 transmitter to the T1 terminal. Key the transmitter and note and record the power output at the "ANT" terminal (test point "C" in diagram). This wattmeter reading should be not much less than half the input reading obtained in Step 3.

Step 5

Repeat Steps 1 - 4 for the remaining channels. If the indicated power loss through each of the channels does not exceed 3.3 db, then the unit is functioning properly. (3.3db loss means that 47% of the power is reaching the antenna terminal). If any of the channels exceed this allowable loss then retuning of the cavities is indicated. See the later section entitled "Retuning Cavities". If the unit has been ordered with frequency spacings less than the recommended minimums (page 1) then a greater loss than 3.3 db can be expected. After this initial test, the system must be matched to the antenna system with which it will be used. The next section discusses that subject.

Matching to the Antenna System

To obtain optimum performance from a junction combiner, one must provide a very "flat" load impedance over the bandwidth occupied by the transmitters connected to the combiner. This can be accomplished by providing a near perfect match to the antenna system at the frequency closest to the center of the operating band. For an antenna system providing a 1.5 to 1 VSWR over the band used, this will generally result in some improvement in VSWR even at the edge frequencies.

The same equipment as used in the initial testing will be used for the following except we will be adding the Antenna Matching Network MB 150, MB 460, or MB 900 depending on the band, and the antenna to be used with the system. The jumper which connects the antenna to the system must be the one which will be used in normal operation.

Step 6

Refer to Figure 1 again. Connect all the transmitters to their respective input terminals. Connect the wattmeter to the "ANT" terminal, test point "C", using the 12" cable. Connect the Antenna Matching Network to the output of the wattmeter. Connect the antenna jumper to the other connector of the Antenna Matching Network.

Step 7

Determine which of the transmitters is closest to the center of the operating band. This transmitter will be used to set the Matching Network.

Step 8

Turn the element of the wattmeter so that it is indicating reflected power. Remove the covers from the variable capacitors on the Matching Network. Key the transmitter selected in Step 7 and adjust both the variable capacitors to minimize the reflected power observed. It will probably be necessary to substitute a

more sensitive element in the wattmeter to more accurately adjust for the desired minimum. Several adjustments of each of the capacitors will be necessary because of their interaction.

Step 9

Check the forward and reflected power of each of the channels in turn. The reflected power should be less than 2% in each case. If it is more than 2% chances are that the basic antenna system VSWR greatly exceeds 1.5 to 1 somewhere within the operating band. This can be checked by removing the Antenna Matching Network and measuring the forward and reflected powers of each of the channels. If any of the channels has reflected power in excess of 4% then the antenna system is out of specification and our simple matching device will probably not be able to correct it satisfactorily for operation with a junction type of combiner. An alternative procedure which may correct such a deficiency in the antenna system is to perform Step 8 on the channel having the highest VSWR or greatest reflected power as measured above. If this technique does not help then one must accept the poor power transfer through the combiner or install an antenna with a VSWR less than 1.5 to 1.

Retuning Cavities

If the initial testing of Steps 1 through Step 5 reveals insertion losses exceeding those shown on the test data sheet, or if a channel or channels have been shifted in frequency then retuning of the cavities is indicated. Note test points "B" in Figure 1. These points are at the output of the isolators for the individual channels. The method used to retune the cavities will be to minimize the reflected power at the individual input terminals while terminating the antenna with a 50 Ohm load. Only one channel's point "B" test point will be opened at a time to insure that the remaining cavities have an isolator terminating them. If the retuning is necessitated by frequency change of all the channels as one might encounter in an 800 MHz trunking system , then it will be simpler to retune the cavities if one starts at the lowest frequency channel if the frequencies are being lowered and at the highest frequency channel if the frequencies are being raised. If only some channels are being moved,no definite guide lines can be given and it will probably be necessary to readjust all the cavities at least twice due to interaction of them. For the following, we will start with the lowest frequency channel or T1.

Step 10

Disconnect the output lead from the isolator in Channel 1 and connect it either directly to the wattmeter, or through an extension cable made up using one of the RG-214 cables and the double female "N" connector. Connect the output of T1 transmitter to the other side of the wattmeter. Connect the "ANT" terminal of the combiner to the 50 Ohm load. Loosen the locknut of the cavity in Channel 1 usin a 9/16" open end wrench. (A pair of 9/16" open end wrenches, one to loosen the locknut and the other to simultaneously adjust the tuning will be necessary.) Set the wattmeter to indicate reflected power,plac

the transmitter in "tune" position, key it and adjust the cavity tuning to obtain minimum reflected power of T1.

Step 11

Reconnect Channel 1 to its isolator and tighten the locking device on Channel 1 cavity. Disconnect the lead from Channel 2 isolator output. Connect it to the wattmeter. Connect Channel 2 transmitter to the other side of the wattmeter, lossen the locking device on Channel 2 cavity and tune it for minimum reflected power as in Step 10 above. Continue the process until all the cavities have been readjusted, making sure that only the channel being tuned is disconnected from its isolator and that the proper transmitter is being used for the channel being retuned.

Step 12

Repeat the above process in reverse order. That is, if you started at T1 and ended at T5 start back at T4, T3, T2 and finally check T1 again.

The combiner should now be checked for power transfer per Steps 1 through 5. The insertion losses should now agree with those on the data sheet shipped with the unit. The unit can now be tuned into the antenna system per Steps 6 through 9. If you still cannot obtain the insertion losses quoted in the data sheet consult the factory for assistance.

U ON

TJ SERIES TRANSMITTER COMBINERS

PARTS DESCRIPTIONS :

$I_1 - I_5$ CC or CD Isolators

$Q_1 - Q_5$ 6.6" Resonators

N1 MB series Antenna Matching Network

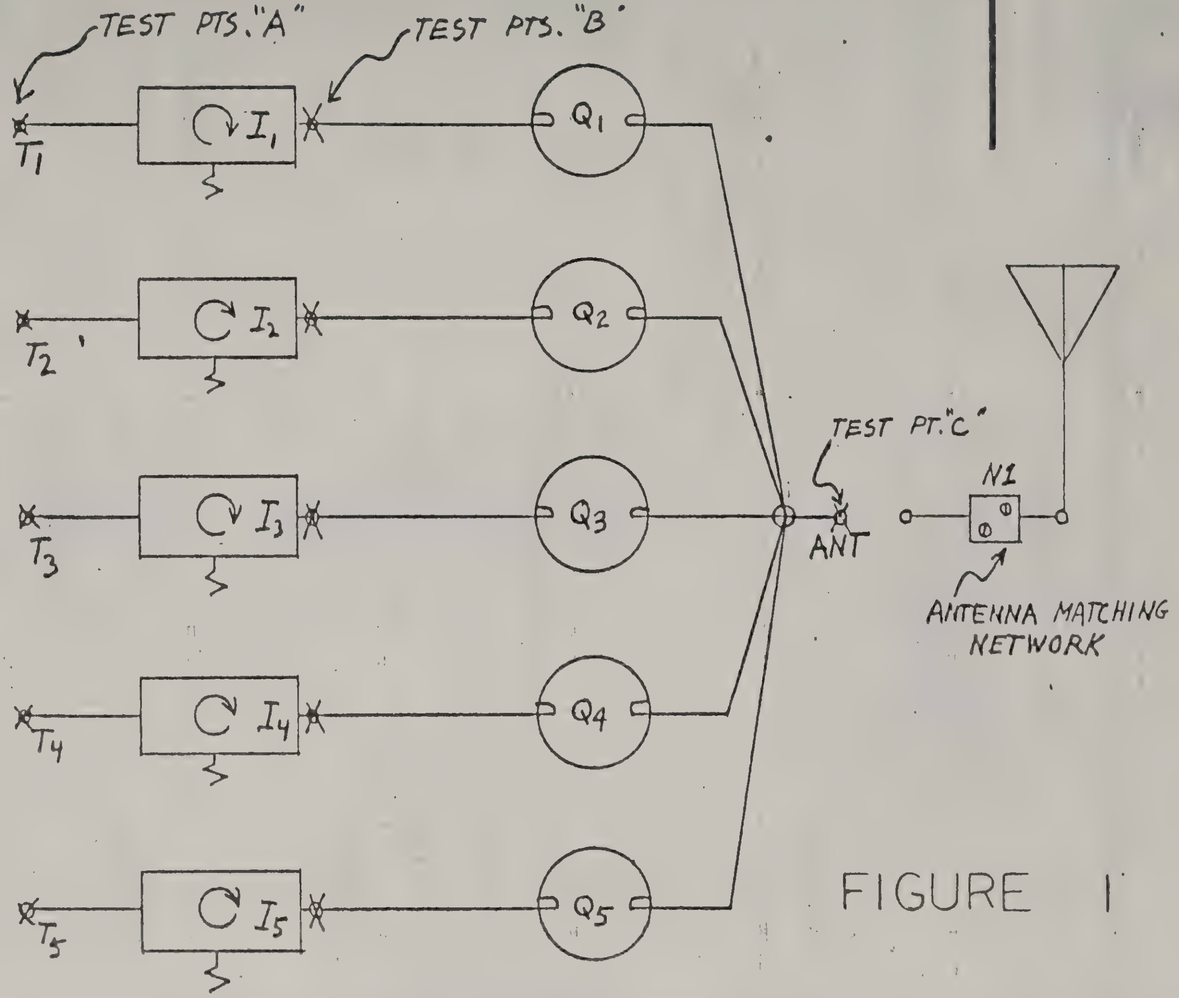


FIGURE 1

Unless otherwise specified — All dimensions are in inches and title block tolerances apply. All thread dimensions to be met after plating where applicable and are to be gauge checked. Break all sharp edges .010-.015 after finish machining. All machined surfaces shall be smooth within 63 micro inches.

REVISION

DIMENSIONAL TOLERANCES		
BASIC	FRACTIONAL	DECIMAL
0"- 1"	± .010	± .003
1"- 6"	± 1/64	± .005
6"- 24"	± 1/32	± .008
ALL ANGLES ± 1°		

TITLE TJ SERIES COMBINER DIAGRAM

DRAWING NO. S-

DRAWN BY ANDRESEN 2-19-82 APPROVED BY 2-19-82

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phelps dodge
Communications Company 115 East Watkins Street, Phoenix, AZ 85004 • (602) 252-8058 • TWX 910-951-4220

OUR NEW NAME IS:
CELWAVE RF, INC.
THE ADDRESS REMAINS THE SAME.
PLEASE CHANGE YOUR RECORDS.

SYSTEM TEST DATA

TRANSMITTER COMBINER
Model: TJC 800-4
Serial: 7-01400-2

Date: 5-14-84
Tested by:

ANTENNA No. 1 COMBINER

ISOLATION (db)
Spec: 35 db min. Xmtr to Xmtr*
Spec: 25 db min. Ant. to Xmtr

T1-T2	56	T3-T1	67	Ant-T1	63
T1-T3	58	T3-T2	51	Ant-T2	41.2
T1-T4	62	T3-T4	49	Ant-T3	39.5
T2-T1	64	T4-T1	69	Ant-T4	41.4
T2-T3	49	T4-T2	58	Tx-Rec	60+
T2-T4	57	T4-T3	46		

INSERTION LOSS (db)
Spec: 2.4 db max.

T1-Ant	1.80	T3-Ant	2.18	Rec-Ant	
T2-Ant	2.15	T4-Ant	2.06		

RETURN LOSS (db)
Spec: 19 min. on T1, T2, T3, and T4
Spec: 14 min. on Ant & Rec. Port

T1	25.5	T2	30.8	T3	21.8	T4	24	ANT-T1	15.2	ANT-T2	[illegible]
								ANT-T3	15.[illegible]	ANT-T4	[illegible]

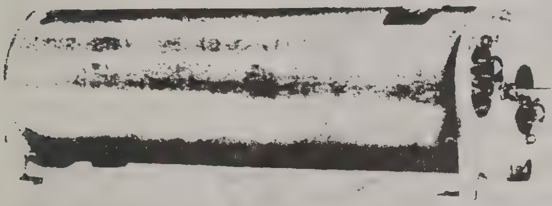
*With hybrid(s) tuned to match antenna termination

FREQUENCIES AS FACTORY TUNED:

T1 856.650 MHz
T2 858.600 MHz
T3 857.600 MHz
T4 [illegible] MHz

INSTRUCTIONS FOR

BANDPASS CAVITY FILTERS



DB-4001	148-174 MHz
DB-4011	70-88 MHz
DB-4015	118-148 MHz
DB-4018	225-400 MHz
DB-4020	406-420 MHz
DB-4021	450-512 MHz
DB-4041	30-50 MHz

GENERAL INFORMATION

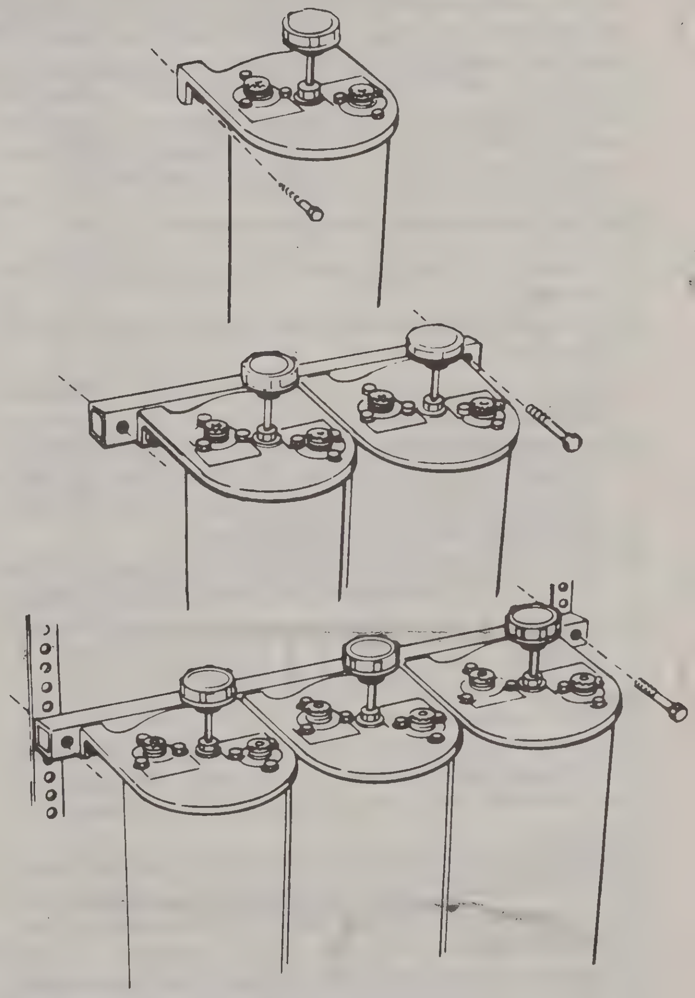
Decibel Products Bandpass Cavity Filters are generally used to provide additional selectivity to a receiving system or to reduce the sideband noise output of a transmitter. The filters, available in one, two, three, or more cavity combinations, have a unique feature enabling a change in selectivity simply by rotating the coupling loops.

CAVITY INSTALLATION

The filters can be mounted easily in practically any location. Single cavity filters have mounting feet provided for attachment to wall or panel. Multiple cavity filters are mounted to two rails which have holes provided for mounting to a wall or panel. The three cavity filter (except DB 4041) is designed to fit a standard rack mount through the holes provided on the rails.

RECEIVER SELECTIVITY IMPROVEMENT

1. Insert the filter between the receiver input and the antenna — or between a signal generator and the receiver if bench tuning. (A 50 ohm pad should be used between the signal generator and the cavity to insure a proper impedance match.)
2. Tune the cavity until a peak reading is obtained on the second limiter. (Care should be taken to insure that the grid current of the second limiter is well below limiting.) Clockwise rotation of the tuning knob lowers the resonant frequency of the cavity.
3. If a multiple cavity filter is being used, tune each cavity for maximum limiter reading. Because of the interaction between the cavities it will be necessary to retune each cavity three or four times to insure proper final adjustments.
4. When the tuning is completed tighten the locknut on the tuning shaft of each cavity.



DECIBEL PRODUCTS, INC.

A SUBSIDIARY OF COMMUNICATIONS INDUSTRIES, INC.

3184 QUEBEC · 214-631-0310 · DALLAS, TEXAS 75247

TRANSMITTER NOISE AND SPURIOUS RADIATION REDUCTION

Method I. Minimum reflected power method.

(a) Install the filter between the transmitter and a matched dummy load.*

(b) Insert an inline wattmeter between the transmitter and the cavity capable of indicating reflected power from the cavity.

(c) Set the transmitter to "tune".

(d) Key the transmitter and tune the cavity for minimum reflected power. This is an indication of proper cavity resonance.

(e) Multiple cavity filters may be tuned by the above method remembering that because of interaction between cavities each cavity may have to be retuned three or four times to insure proper final adjustment.

(f) Remove the wattmeter from the line and connect the transmitter and filter to the antenna. No further tuning should be necessary.

*This tuning method should not be used with the antenna connected to the system. A condition could exist where a reactive mismatch due to the antenna would be cancelled by the off-resonance reactance of the cavity filter. This would leave the filter, although apparently tuned, off resonance presenting a higher insertion loss to the transmitted signal. Multiple cavity filters are more critical in this respect.

Method 2 — Maximum power method

(a) Install the filter between the transmitter and the antenna.

(b) Insert a wattmeter between the antenna and the filter.

(c) Set the transmitter to "tune" and the wattmeter to read "forward".

(d) Key the transmitter and adjust the cavity (s) for maximum power to the antenna. (For multiple cavity filters retune each cavity three or four times for proper final adjustment.)

(e) Set the transmitter to "operate" and again retune the cavity (s) for maximum power to the antenna.

(f) Tighten locknuts on cavities and remove wattmeter.

Note:

With some transmitters it may be necessary, because of impedance mismatches, to optimize the length of cable between the transmitter and the first cavity in the filter.

The need for this optimization will be apparent when the output power from the transmitter is reduced by more than the amount absorbed in the cavity (s) due to insertion loss.

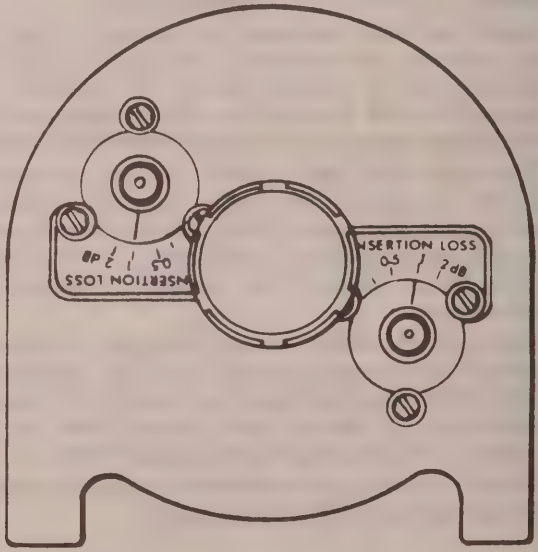
The optimum length of cable between the transmitter and the cavity may be empirically found by the following method:

1. Tune the transmitter to its antenna according to the instruction book.
2. Insert the cavity (s), which have been tuned by either of the previous methods, between the transmitter and the antenna. If there is a mismatch problem the cavity will detune the transmitter.
3. Using either short lengths of cable or UG646 elbows increase cable lengths between the transmitter and cavity (s) until there is little or no interaction or detuning between the transmitter and the cavity (s).
4. Replace the cable containing the UG646 elbows and/or short lengths with a continuous length of cable of equivalent electrical length (1 elbow is approximately 1½" of RG 8 or 9). The system should now be optimized.

ADJUSTING SELECTIVITY

Each bandpass cavity filter is provided with adjustable selectivity capability. This is accomplished by physically rotating the coupling loops within the cavity to positions corresponding to total cavity attenuations of ½dB, 1 dB or 2dB. Setting the loops to a higher insertion loss increases the selectivity or sharpens the frequency response curve of the cavity. The total insertion loss of a **single** cavity will be approximately that of the calibrated decal. To set the cavity to a particular insertion loss align the marks on both connector discs to the insertion loss desired. For example, if 1 dB insertion loss is desired set both loops to the 1 dB mark. Both loops **must** be set to the same insertion loss mark for proper impedance match (VSWR).

The total insertion loss of a multiple cavity filter is approximately the sum of the losses of the individual cavities. For example, if a 1.5 dB insertion loss is desired for a three cavity filter, the loop settings of the individual cavities should be at 0.5 dB.



095055-000

DB-4002-A 118-148 MHz
DB-4002-B 144-174 MHz
DB-4002-C 406-420 MHz
DB-4002-D 450-512 MHz

HIGH Q CAVITY FILTERS

INSTALLATION & TUNING INSTRUCTIONS

GENERAL. Decibel Products' High Q Cavity Filters are designed to provide additional selectivity to a receiving system or to reduce the sideband noise output of a transmitter. Each cavity is supplied with three sets of coupling loops. The insertion loss values for these coupling loop sets are approximately 0.5 dB, 1.0 dB, and 3.0 dB.

CAVITY INSTALLATION. The cavity can be mounted in practically any location. However, for best results, it should be mounted vertically in a place where it will be protected from rapid temperature changes and where it will not be exposed to the elements.

The cavity has a bracket provided for attachment to a wall or panel. The following procedure should be used.

1. Remove the mounting bracket from the cavity by means of the 3/8″ x 1/2″ bolt.
2. Using the bracket as a template, drill five 9/32″ mounting holes.
3. Attach the bracket to the mounting surface using five 1/4″ bolts.
4. Mount the cavity on the bracket using the original 3/8″ x 1/2″ bolt.

When the correct loops have been selected, (see Table I for color coding of loops) install the loops as follows:

1. Insert the loops in the holes in the side of the cavity such that the end of the loops can be secured to the top of the cavity by means of the 6-32 x 1/2 inch screw and lockwasher.
2. Secure the UHF panel connectors to the cavity by means of the 4—40 screws and lockwashers provided.

TABLE I — LOOP COLOR CODE MARKING

Model No.	Freq. Range	.5 dB Loops	1.0 dB Loops	3.0 dB Loops
DB-4002-A	118-148 MHz	2 Yellow dots	2 Blue dots	2 Brown dots
DB-4002-B	144-174 MHz	1 Yellow dot	1 Blue dot	1 Brown dot
DB-4002-C	406-420 MHz	2 Green dots	2 Orange dots	2 Black dots
DB-4002-D	450-512 MHz	1 Green dot	1 Orange dot	1 Black dot

RECEIVER SELECTIVITY IMPROVEMENT

1. Insert the filter between the receiver input and the antenna (or between a signal generator and the receiver if bench tuning). (A 50 ohm pad should be used between the signal generator and the cavity to insure a proper impedance match).
2. With a signal on the proper frequency being fed to the receiver, tune the cavity until a peak reading is obtained on the limiter. (Care should be taken to insure that the grid current of the limiter is well below limiting). Clockwise rotation of the upper tuning knob increases the resonant frequency of the cavity.
3. If a multiple cavity filter is being used, tune each cavity for maximum limiter reading. Because of the interaction between the cavities it will be necessary to retune each cavity three or four times to insure proper final adjustments.
4. When the tuning is completed tighten the upper and lower tuning knobs while still observing limiter reading to be sure cavity is properly tuned. The cavity tuning is very sharp due to its high Q.

TRANSMITTER NOISE AND SPURIOUS RADIATION REDUCTION

Method 1. Minimum reflected power method.*

(a) Install the filter between the transmitter and a matched dummy load.

(b) Insert an inline wattmeter between the transmitter and the cavity capable of indicating reflected power from the cavity.

(c) Set the transmitter to "tune".

(d) Key the transmitter and tune the cavity for minimum reflected power. This is an indication of proper cavity resonance.

*This tuning method should not be used with the antenna connected to the system. A condition could exist where a reactive mismatch due to the antenna would be cancelled by the off-resonance reactance of the cavity filter. This would leave the filter, although apparently tuned, in an off resonance condition presenting a higher insertion loss to the transmitted signal. Multiple cavity filters are more critical in this respect.

(e) Multiple cavity filters may be tuned by the above method remembering that because of interaction between cavities each cavity may have to be retuned three or four times to insure proper final adjustment.

(f) Switch the transmitter from "tune" to "operate" and repeat (d) and (e).

(g) Remove the wattmeter from the line and connect the transmitter and filter to the antenna. No further tuning should be necessary.

Method 2 — Maximum power method

(a) Install the filter between the transmitter and the antenna.

(b) Insert a wattmeter between the antenna and the filter.

(c) Set the transmitter to "tune" and the wattmeter to read "forward".

DECIBEL PRODUCTS, INC.

(d) Key the transmitter and adjust the cavity(s) for maximum power to the antenna. (For multiple cavity filters retune each cavity three or four times for proper final adjustment).

(e) Set the transmitter from "tune" to "operate" and again retune the cavity(s) for maximum power to the antenna.

(f) Tighten knobs on cavities and remove wattmeter.

NOTE: With some transmitters it may be necessary, because of impedance mismatches, to optimize the length of cable between the transmitter and the first cavity in the filter.

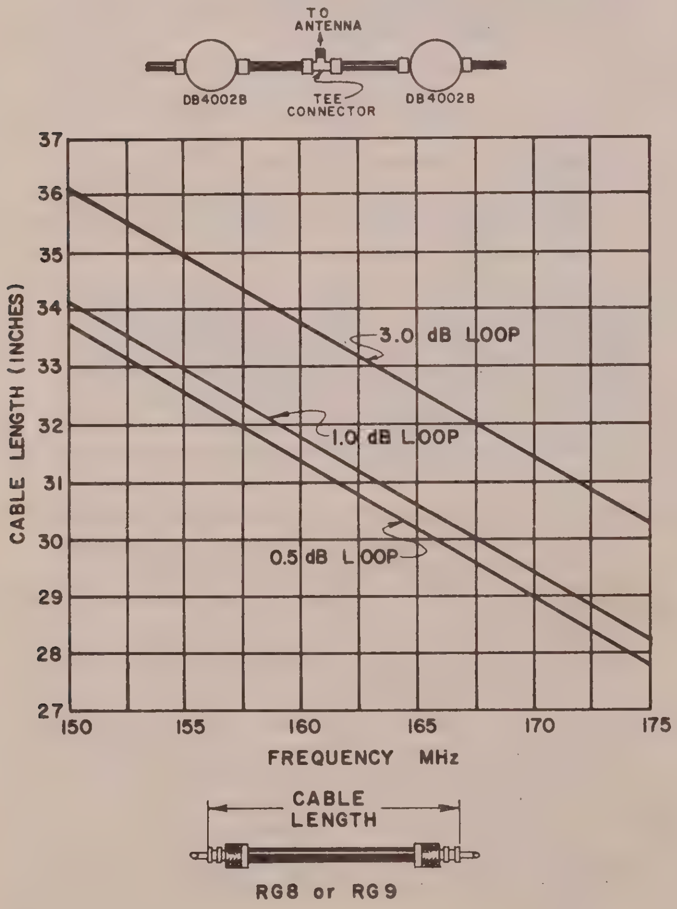
The need for this optimization will be apparent when the output power from the transmitter is reduced by more than the amount absorbed in the cavity(s) due to insertion loss.

For example: If the cavity has 1.0 dB loops installed but it appears that 1.5 or 2.0 dB is lost through the cavity at resonance.

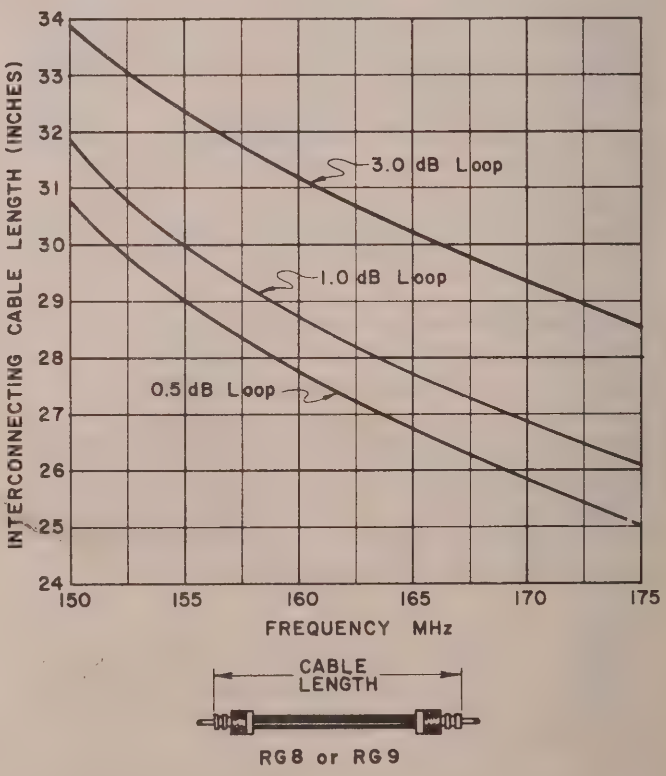
The optimum length of cable between the transmitter and the cavity may be found empirically by the following method:

1. Tune the transmitter to its antenna according to the instruction book.
2. Insert the cavity(s), which have been tuned by either of the previous methods, between the transmitter and the antenna. If there is a mismatch problem the cavity will detune the transmitter.
3. Using either short lengths of cable or UG646 elbows increase cable lengths between the transmitter and cavity(s) until there is little or no interaction or detuning between the transmitter and the cavity(s). i.e., the amount of power lost in the cavity is approximately the same as the loop values.
4. Replace the cable containing the UG646 elbows and/or short lengths with a continuous length of cable of equivalent electrical length (1 elbow is approximately 1½" of RG 8 or 9). The system should now be optimized.

CABLE LENGTHS BETWEEN DB4002B CAVITY AND ANTENNA TEE CONNECTOR FOR DUPLEX OPERATION



INTERCONNECTING CABLE LENGTHS FOR QUARTER-WAVE COUPLING DB-4002B CAVITIES



DB4026-DB4028
BANDPASS CAVITY FILTER

GENERAL

DECIBEL PRODUCTS' BANDPASS CAVITY FILTERS ARE DESIGNED TO PROVIDE ADDITIONAL SELECTIVITY TO A RECEIVING SYSTEM OR TO REDUCE THE SIDEBAND NOISE OUTPUT OF A TRANSMITTER, EACH CAVITY HAS THREE COUPLING LOOP SETTINGS. THE INSERTION LOSS VALUES FOR THESE LOOP SETTINGS ARE APPROXIMATELY 0.5dB, 1.0dB AND 2.0dB.

RECEIVER SELECTIVITY IMPROVEMENT

1. INSERT THE FILTER(S) BETWEEN THE RECEIVER INPUT AND THE ANTENNA (OR BETWEEN A SIGNAL GENERATOR AND THE RECEIVER IF BENCH TUNING). (A 50 OHM PAD SHOULD BE USED BETWEEN THE SIGNAL GENERATOR AND THE CAVITY TO INSURE A PROPER IMPEDANCE MATCH.)

2. WITH A SIGNAL ON THE PROPER FREQUENCY BEING FED TO THE RECEIVER, TUNE THE CAVITY(IES) UNTIL A PEAK READING IS OBTAINED ON THE LIMITER. (CARE SHOULD BE TAKEN TO INSURE THAT THE GRID CURRENT OF THE LIMITER IS WELL BELOW LIMITING.) CLOCKWISE ROTATION OF THE UPPER TUNING KNOB INCREASES THE RESONANT FREQUENCY OF THE CAVITY.

3. BECAUSE OF THE INTERACTION BETWEEN THE MULTIPLE CAVITY COMBINATIONS, IT WILL BE NECESSARY TO RETUNE EACH CAVITY THREE (3) OR FOUR (4) TIMES TO INSURE PROPER FINAL ADJUSTMENT.

4. WHEN THE TUNING IS COMPLETED TIGHTEN TUNING SCREW SHAFT NUT WHILE STILL OBSERVING THE LIMITER READING TO BE SURE THE CAVITY(IES) IS PROPERLY TUNED.

TRANSMITTER NOISE AND RADIATION REDUCTION

METHOD 1. MINIMUM REFLECTED POWER METHOD. *

A. INSTALL THE FILTER(S) BETWEEN THE TRANSMITTER AND A MATCHED DUMMY LOAD.

B. INSERT AN INLINE WATTMETER BETWEEN THE TRANSMITTER AND THE CAVITY CAPABLE OF INDICATING REFLECTED POWER FROM THE CAVITY.

C. SET THE TRANSMITTER TO "TUNE".

D. KEY THE TRANSMITTER AND TUNE THE CAVITY(IES) FOR MINIMUM REFLECTED POWER. THIS IS AN INDICATION OF PROPER CAVITY RESONANCE.

E. BECAUSE OF INTERACTION BETWEEN MULTIPLE CAVITY COMBINATIONS, EACH CAVITY MAY HAVE TO BE RETUNED THREE (3) OR FOUR (4) TIMES TO INSURE PROPER FINAL ADJUSTMENT.

F. SWITCH THE TRANSMITTER FROM "TUNE" TO "OPERATE" AND REPEAT (D) AND (E).

G. REMOVE THE WATTMETER FROM THE LINE AND CONNECT THE TRANSMITTER AND FILTER(S) TO THE ANTENNA. NO FURTHER TUNING SHOULD BE NECESSARY.

* THIS TUNING METHOD SHOULD NOT BE USED WITH THE ANTENNA CONNECTED TO THE SYSTEM. A CONDITION COULD EXIST WHERE A REACTIVE MISMATCH DUE TO THE ANTENNA WOULD BE CANCELLED BY THE OFF-RESONANCE REACTANCE OF THE CAVITY FILTER(S). THIS WOULD LEAVE THE FILTER(S) ALTHOUGH APPARENTLY TUNED, IN AN OFF RESONANCE CONDITION PRESENTING A HIGHER INSERTION LOSS TO THE TRANSMITTED SIGNAL.

METHOD 2. MAXIMUM POWER METHOD

A. INSTALL THE FILTER(S) BETWEEN THE TRANSMITTER AND THE ANTENNA.

B. INSERT A WATTMETER BETWEEN THE ANTENNA AND THE FILTER(S).

C. SET THE TRANSMITTER TO "TUNE" AND THE WATTMETER TO READ "FORWARD".

D. KEY THE TRANSMITTER AND ADJUST THE CAVITY(IES) FOR MAXIMUM POWER TO THE ANTENNA.

E. BECAUSE OF INTERACTION BETWEEN MULTIPLE CAVITY COMBINATIONS EACH CAVITY MAY HAVE TO BE RETUNED THREE (3) OR FOUR (4) TIMES TO INSURE PROPER FINAL ADJUSTMENT.

F. SET THE TRANSMITTER FROM "TUNE" TO "OPERATE" AND AGAIN RETUNE THE CAVITY(IES) FOR MAXIMUM POWER TO THE ANTENNA.

G. TIGHTEN TUNING SCREW SHAFT NUT ON THE CAVITY(IES) AND REMOVE WATTMETER.

NOTE: WITH SOME TRANSMITTERS IT MAY BE NECESSARY BECAUSE OF IMPEDANCE MISMATCHES, TO OPTIMIZE THE LENGTH OF CABLE BETWEEN THE TRANSMITTER AND THE FIRST CAVITY IN THE FILTER COMBINATION.

INSERTION LOSS ADJUSTMENT

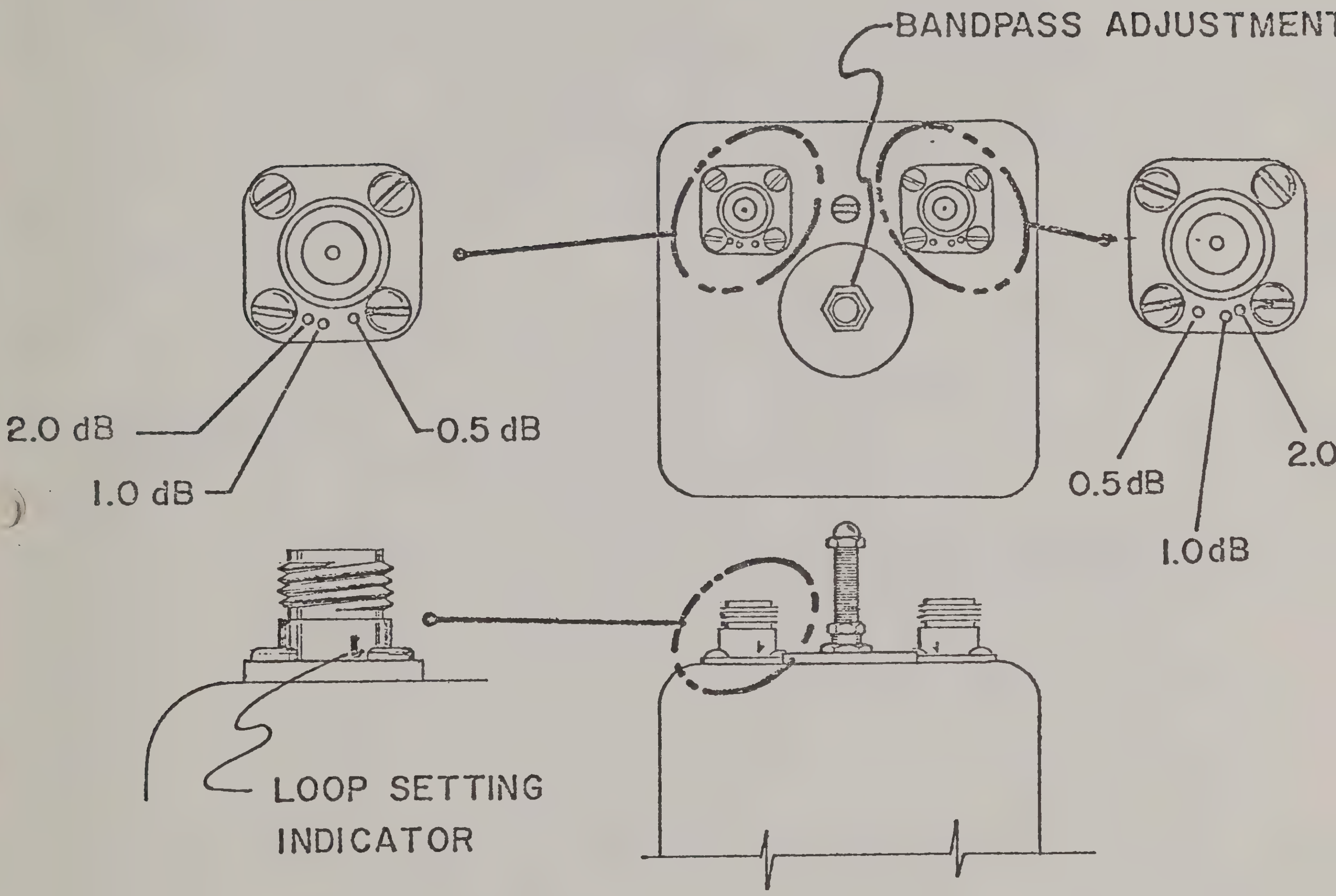


FIG. 1

DB-4090

806-949 MHz BAND-PASS/REJECT DUPLEXER

GENERAL

The DB-4090 is designed for use in 806-949 MHz when transmitter and receiver frequencies are separated by 45 MHz. It utilizes two (2) identical 1/4 wave cavities and employs a separate notching adjustment. Each section provides 65 dB (nominally) isolation to transmitter noise or receiver desensitization.

FIELD TUNING

The duplexer is factory-tuned to the exact operating frequencies and shipped ready for immediate installation. No further field tuning or adjustment is required. If it becomes necessary to change the operating frequencies of the duplexer, it may be returned to the factory for retuning or may be field-tuned if the following equipment is available:

1. A signal generator (50 ohm) capable of producing a signal at the transmitter and receiver frequencies.
2. A receiver tuned to the desired receiver frequency.
3. A receiver tuned to the desired transmitter frequency.
4. One 50 ohm pad.
5. One 50 ohm termination.

FIELD TUNING PROCEDURE (SEE FIGURES 1 AND 2)

1. Connect equipment as shown in Figure 3a.
2. Loosen the hex nut which locks the threaded tuning rod on each cavity.
3. Tune the signal generator to the desired higher frequency.
4. Tune the band-pass adjustment of the high frequency cavity of the duplexer while observing the limiter reading of receiver #1. Tune for maximum limiter reading. (Clockwise on tuning screw decreases resonant frequency of cavity.)

5. Lock tuning screw shaft nut after tuning the cavity.

6. Disconnect receiver #1 and connect receiver #2.

7. Tune signal generator to the desired lower frequency.

8. Tune the notching adjustment of the high pass cavity for minimum signal into receiver #2.

9. Connect equipment as shown in Figure 3b.

10. Tune signal generator to the desired lower frequency.

11. Tune the band-pass adjustment of the low frequency cavity of the duplexer observing the limiter reading of receiver #2. Tune for maximum limter reading.

12. Lock tuning screw shaft nut after tuning each cavity.

13. Disconnect receiver #2 and connect receiver #1.

14. Tune signal generator to desired higher frequency.

15. Tune the low pass cavity notching adjustment for minimum signal into receiver #1.

16. Duplexer is tuned.

17. To summarize: Tune the band-pass adjustment of the high pass cavity to pass the higher frequency and notching adjustment to reject the lower frequency; tune the band-pass adjustment of the low pass cavity to pass the lower frequency and notching adjustment to reject the higher frequency.

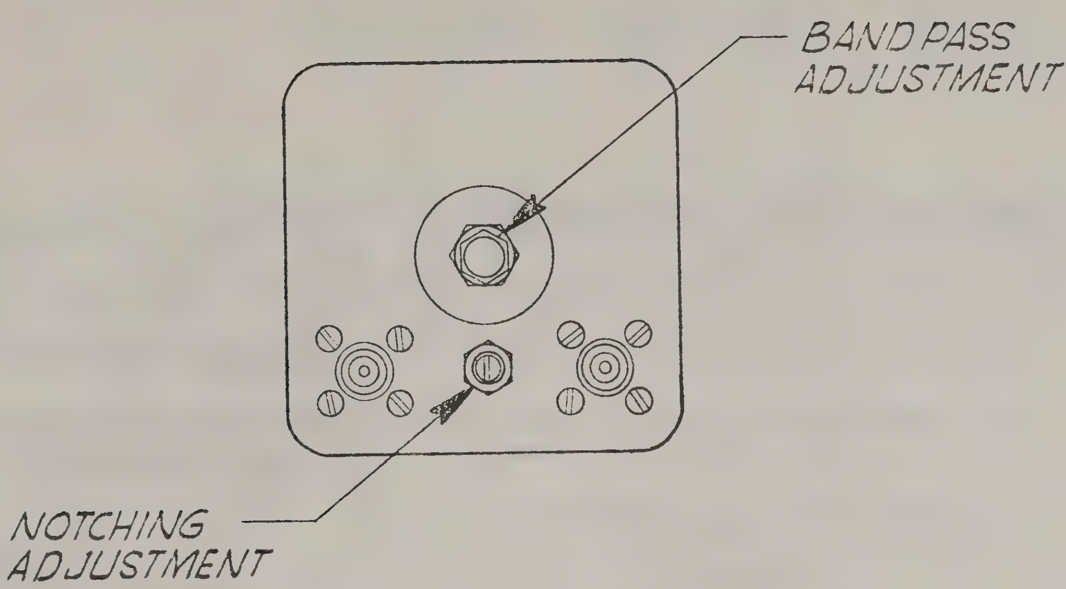


FIGURE 1

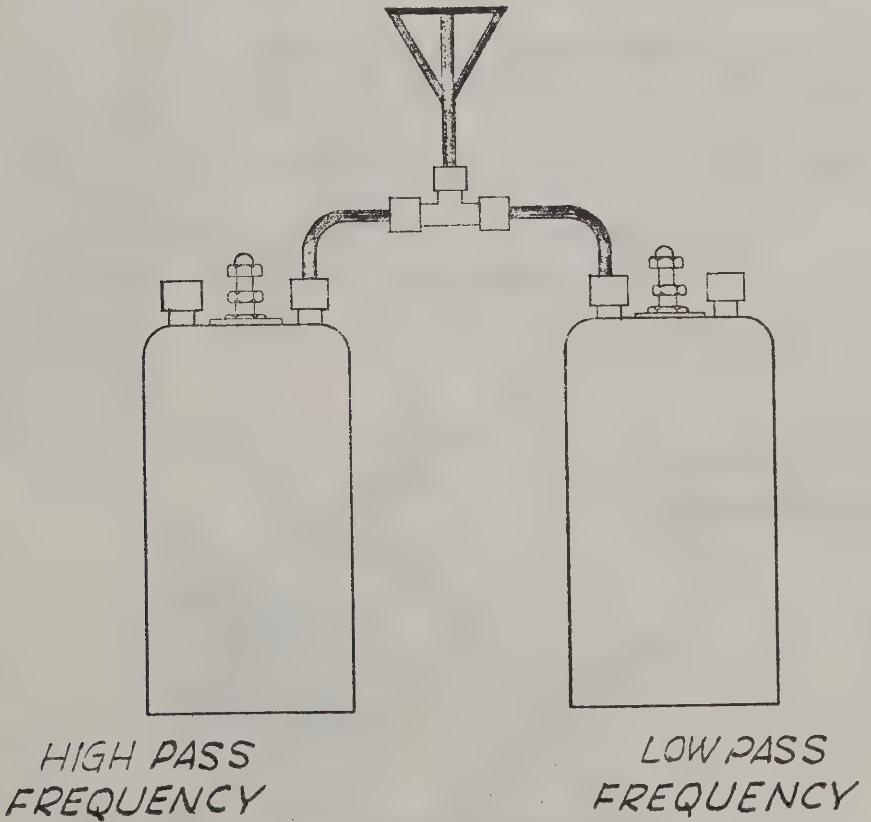
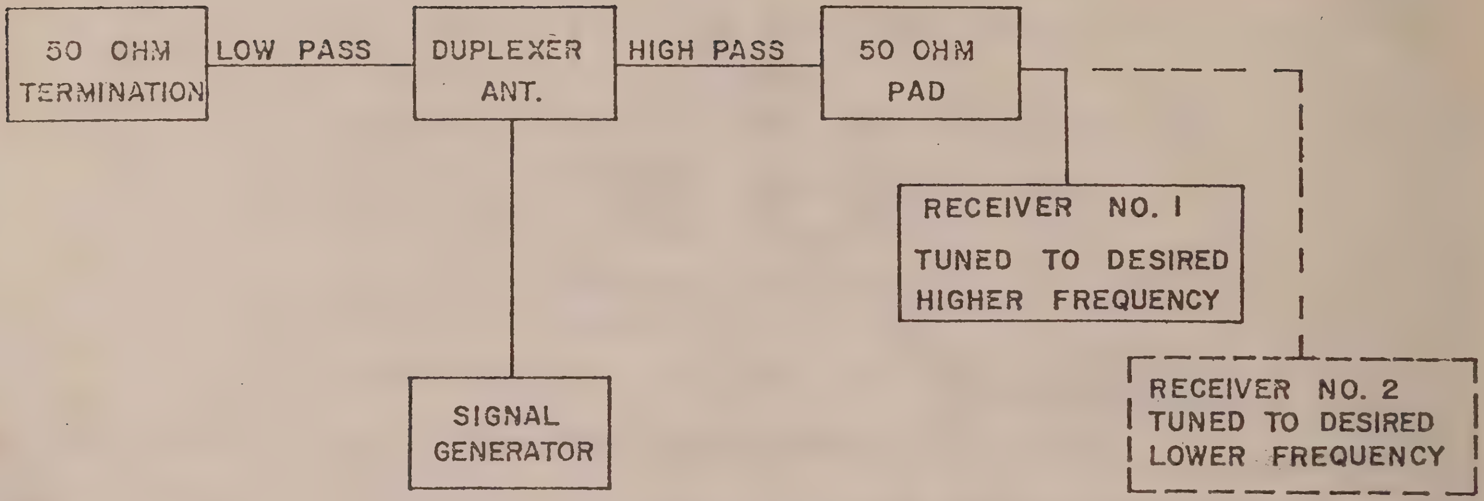


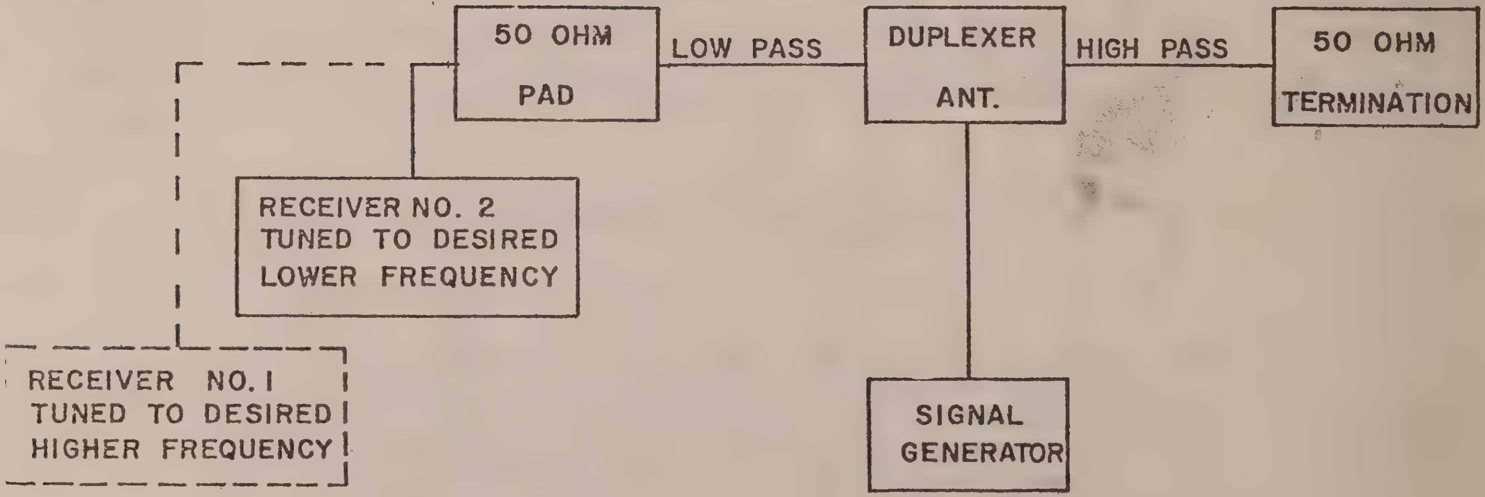
FIGURE 2

FIELD TUNING EQUIPMENT



50 OHM TERMINATION
LOW PASS
DUPLEXER ANT.
HIGH PASS
50 OHM PAD
RECEIVER NO. 1 TUNED TO DESIRED HIGHER FREQUENCY
SIGNAL GENERATOR
RECEIVER NO. 2 TUNED TO DESIRED LOWER FREQUENCY

FIGURE 3a



50 OHM PAD
LOW PASS
DUPLEXER ANT.
HIGH PASS
50 OHM TERMINATION
RECEIVER NO. 2 TUNED TO DESIRED LOWER FREQUENCY
RECEIVER NO. 1 TUNED TO DESIRED HIGHER FREQUENCY
SIGNAL GENERATOR

FIGURE 3b

INSTALLATION INSTRUCTIONS
for NOTCH FILTERS

Model DB-4105	Model DB-4140	Model DB-4175
30 - 50 mc	148 - 174 mc	450 - 470 mc

General

The Decibel "Notch Filter" is designed for use in certain radio systems where interfering signals are degrading the performance of the system. These narrow band band-stop filter networks provide the means to pass the station operating frequency with low insertion loss while rejecting an interfering signal which is very close to the "pass" frequency.

Maximum power handling capability of the filter is dependent upon the insertion loss at the operating frequency as shown below:

Insertion Loss	Power Rating (continuous)
1.0 db	350 watts
2.0 db	250 watts
3.0 db	100 watts

Installation

he filter can be mounted either vertically or horizontally and is usually mounted near or on the base station cabinet (the interconnecting cable length between filter and station is not critical). To install, simply insert the filter in the transmission line circuit by means of the UHF tee (M-358) on the cavity. (see Figure 1) Since the filter has been factory tuned, no further adjustment is necessary.

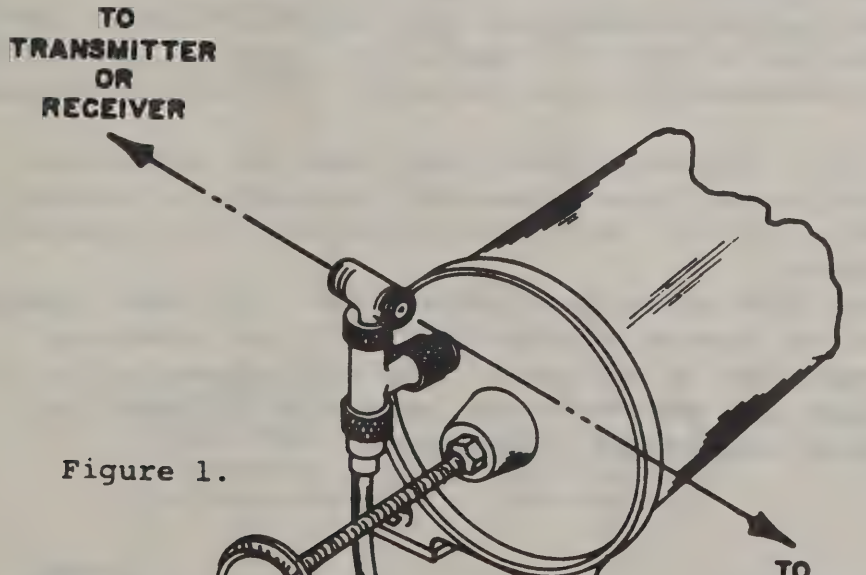


Figure 1.

F-100
6-18-68

095067-000

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Field Tuning

The Notch Filters are factory-tuned to the exact pass and reject frequencies and shipped ready for immediate installation. No further field tuning or adjustment is required. If it becomes necessary to change the frequencies of a Notch Filter it may be returned to the factory for retuning or may be field-tuned * if the following equipment is available.

1. A signal generator (50 ohms) capable of producing a signal at the reject frequency.
2. A receiver tuned to the desired reject frequency.
3. Two 50 ohm pads.

*Note: There are different types of Notch Filters in each of the frequency bands. Each model will have basically the same frequency response across its own band. If it becomes necessary to change the frequency response a different stub-harness configuration is needed.

Field Tuning Procedure

1. Connect equipment as shown in Figure 2a.
2. Tune the signal generator to the desired reject frequency.
3. Tune each cavity for minimum signal into the receiver. (Clockwise on tuning screw decreases resonant frequency of cavity).
4. Lock tuning screw nut after tuning each cavity.

Laboratory Tuning Procedure

1. Connect equipment as shown in Figure 2b.
2. Connect the 3 db pads to the Notch Filter terminals.
3. Tune signal generator to within 1 KHz of the reject frequency using the frequency counter.
4. Tune the local oscillator 30 MHz below the reject frequency to obtain a reading on the 30 MHz I.F. amplifier. Add or remove attenuation with the decade attenuators until I.F. amplifier reads on scale.
5. Tune each cavity for a minimum signal into the I.F. amplifier. (Clockwise on tuning screw lowers resonant frequency of cavity).
6. Set reference reading on I.F. amplifier meter and note attenuation in decade attenuators.
7. Remove Notch Filter from set-up and connect the 3 db pads together. Add attenuation in the decade attenuators until the reference reading on I.F. amplifier is achieved. The difference in the decade attenuation readings from step 6 is the amount of attenuation through the filter at the reject frequency.

③

8. Lock tuning screw shaft after tuning each cavity.
9. With test equipment tuned to the pass frequency measure insertion loss of the filter at the pass frequency.

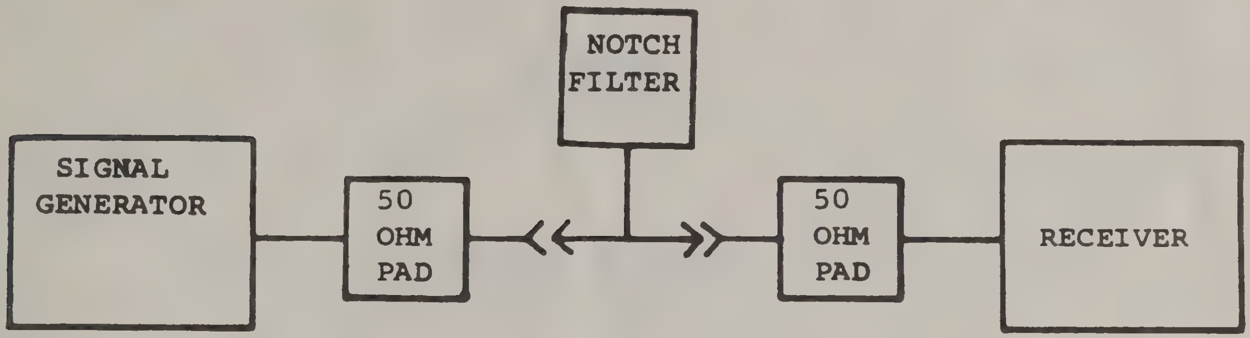
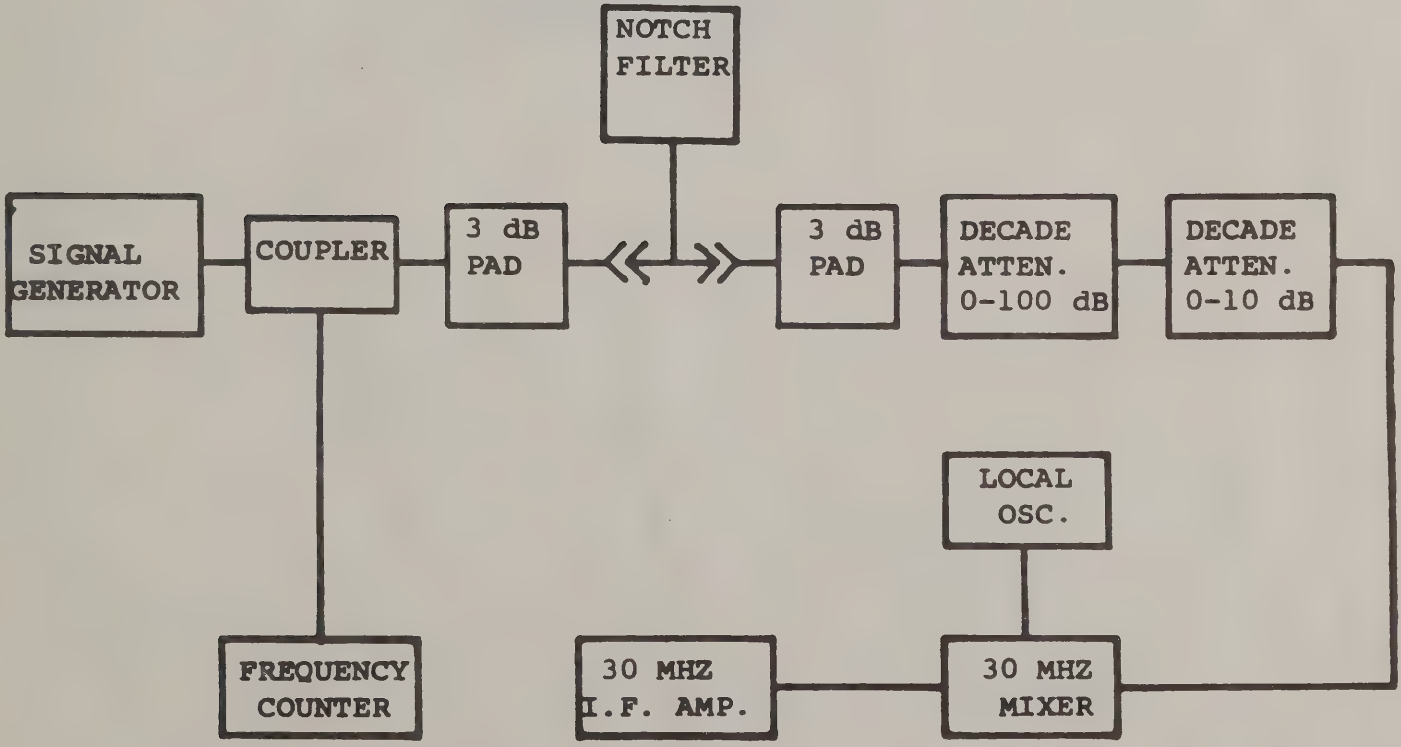


FIGURE 2a. FIELD TUNING EQUIPMENT



F-100
6-18-68

FIGURE 2b. LABORATORY TUNING EQUIPMENT

TUNING INSTRUCTIONS

FOR

PD-500

SERIES

CAVITIES

CELWAVE R.F. INC.
MARLBORO, N.J.
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CEL-56

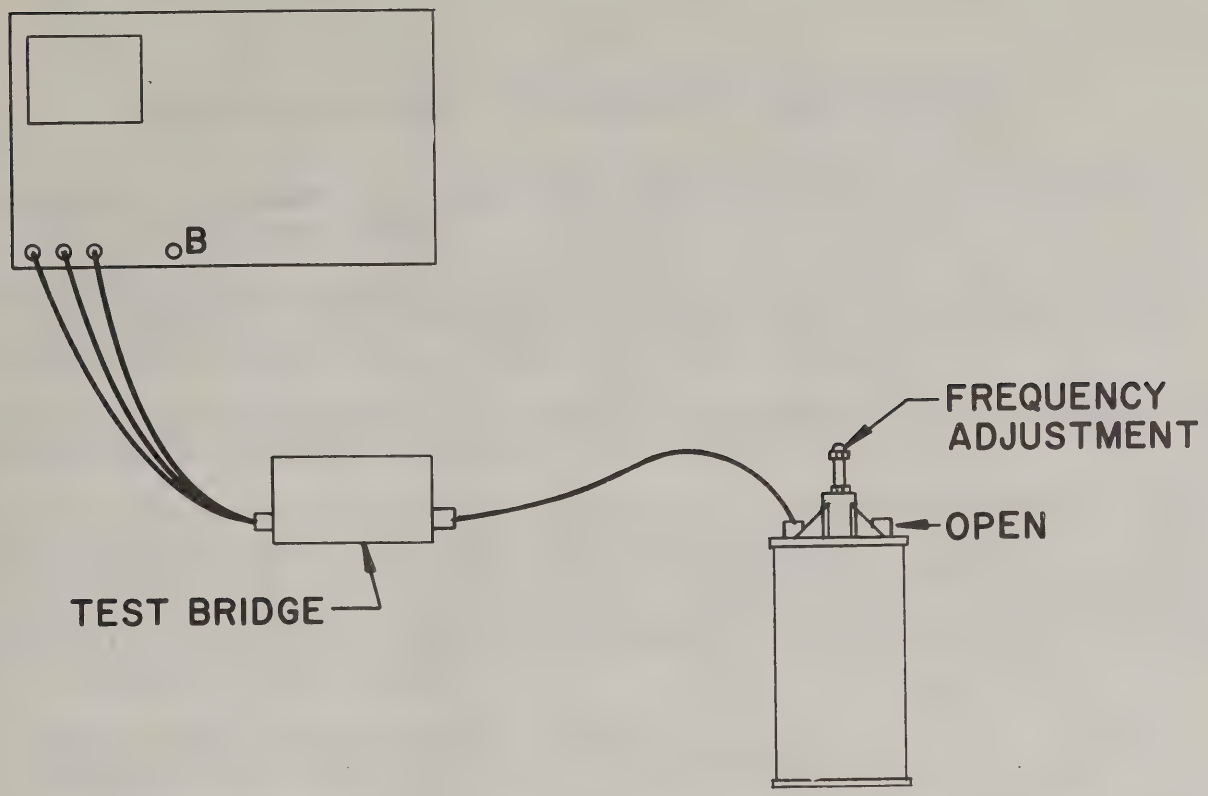


FIGURE I

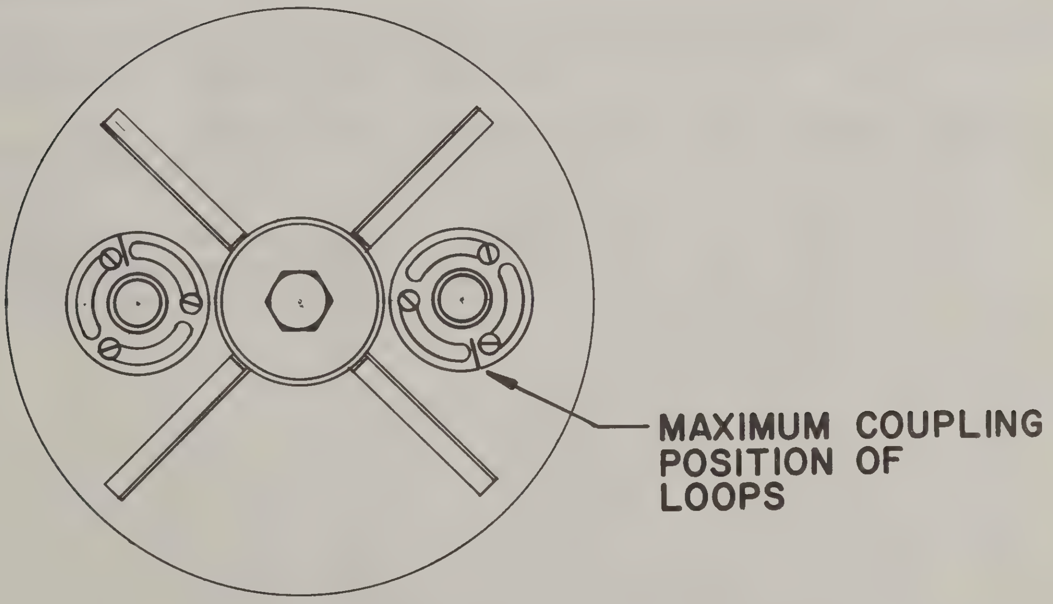


FIGURE 2

Tuning Procedure for BP Cavities with Rotatable Loops

This procedure is applicable to coaxial TEM cavities that operate in the quarter-wave or three quarter-wave mode.

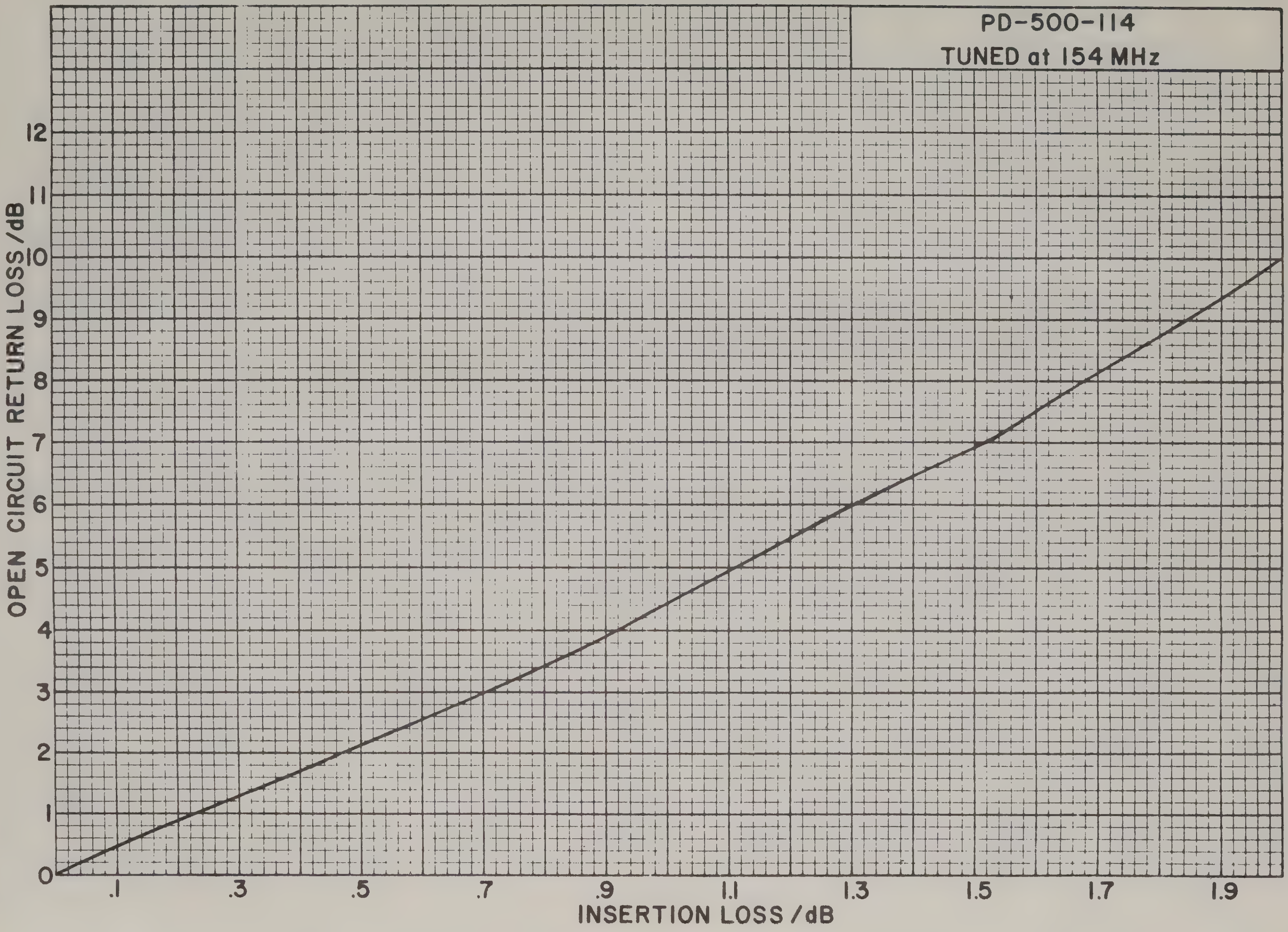
Adjustment of the pass frequency is made by means of the invar adjustment screw at the top of the cavity. The inner conductor of the cavity is lengthened or shortened by this screw to lower or raise the resonant frequency.

The insertion loss and therefore the selectivity of the cavity is set by rotating the loops to adjust the coupling into and out of the cavity. See Figure 2.

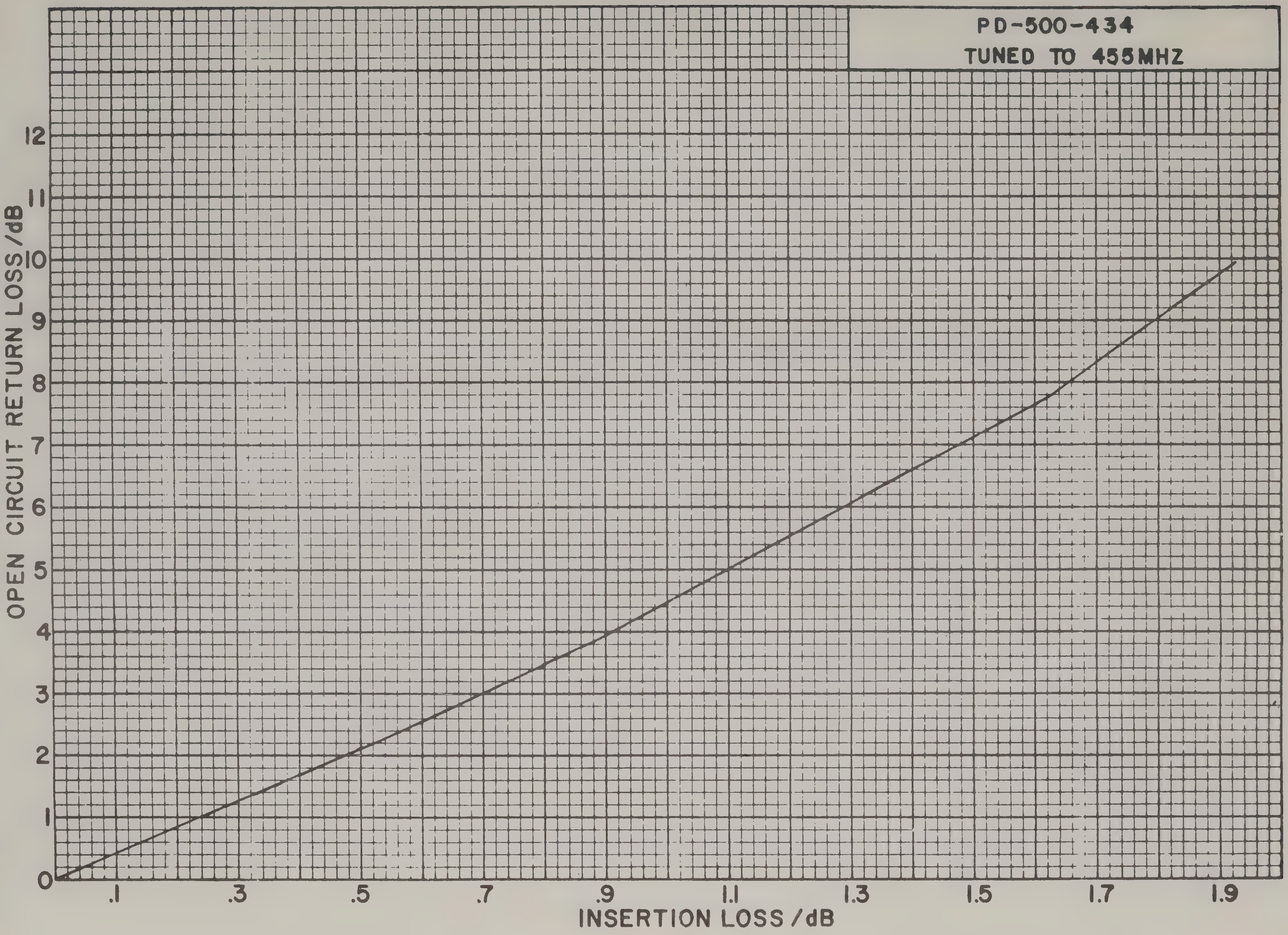
The insertion loss is set by an open circuit (O.C.) return loss measurement. This will allow a balanced return loss when looking into either port. Therefore a device that can measure return loss vs. frequency will be required. (HP-8754, HP-8505, etc.) Each cavity type will have its own I.L.vs. O.C. return loss curve. Determine from the proper curve the correct O.C. return loss setting for the desired insertion loss. Follow the procedure listed below:

1. Connect the cavity as shown in Figure 1.
   Rotate the first loop to a slightly uncoupled position.
2. Adjust the tuning screw of cavity for maximum return loss at the desired center frequency.
3. Adjust the first loop for the specified O.C. return loss at the maximum return loss point.
4. Connect the test bridge to the second port and adjust for the proper O.C. return loss at the maximum return loss point.
5. If the second loop had to be rotated a lot from its initial position, return to Step 3 and repeat.
6. Connect test equipment to measure insertion loss.
   Adjust center frequency if necessary.
   Tighten all screws and locking nuts.

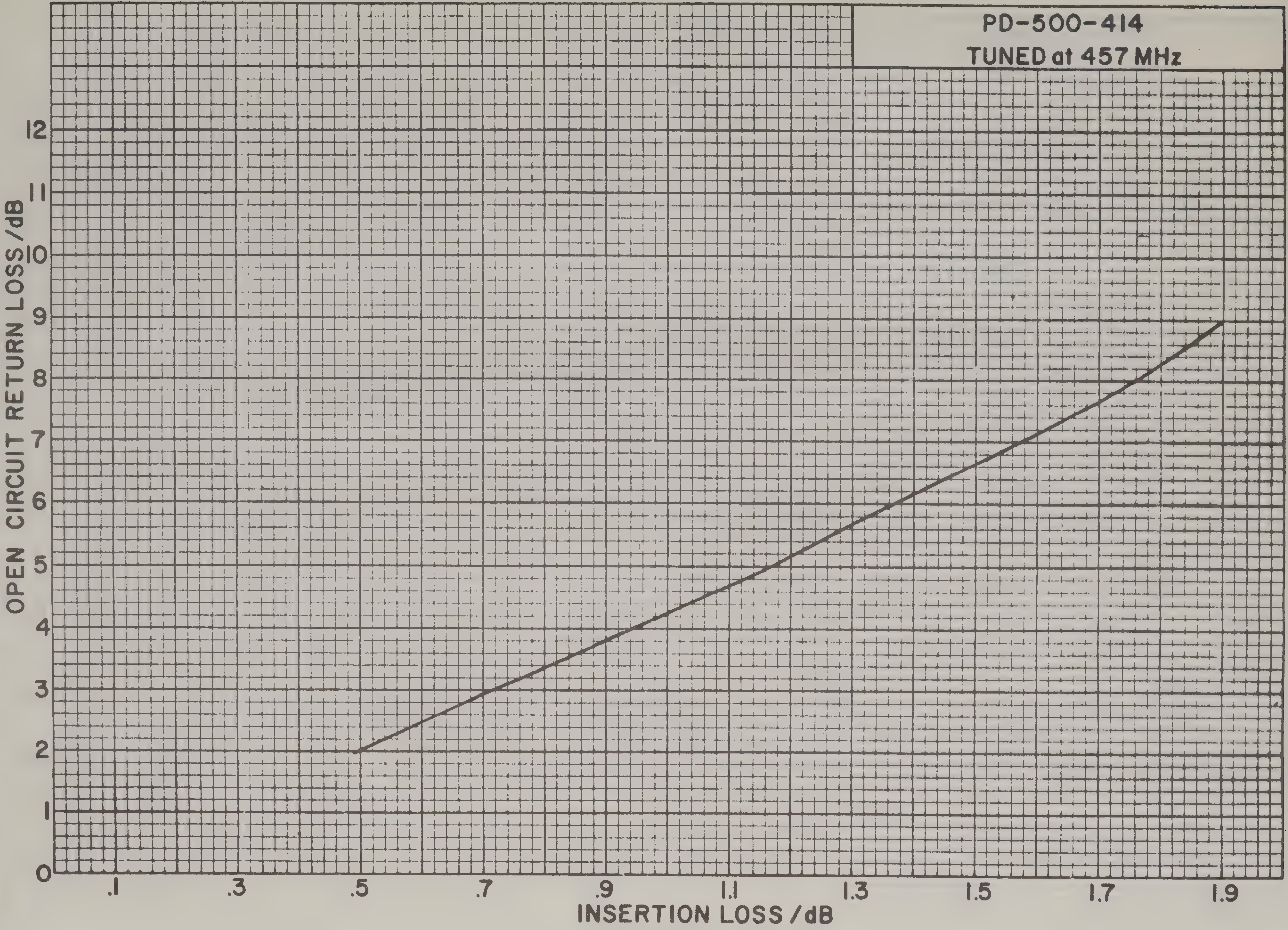
K+E 5 X 5 TO THE ½ INCH 359-6
KEUFFEL & ESSER CO. MADE IN U.S.A.



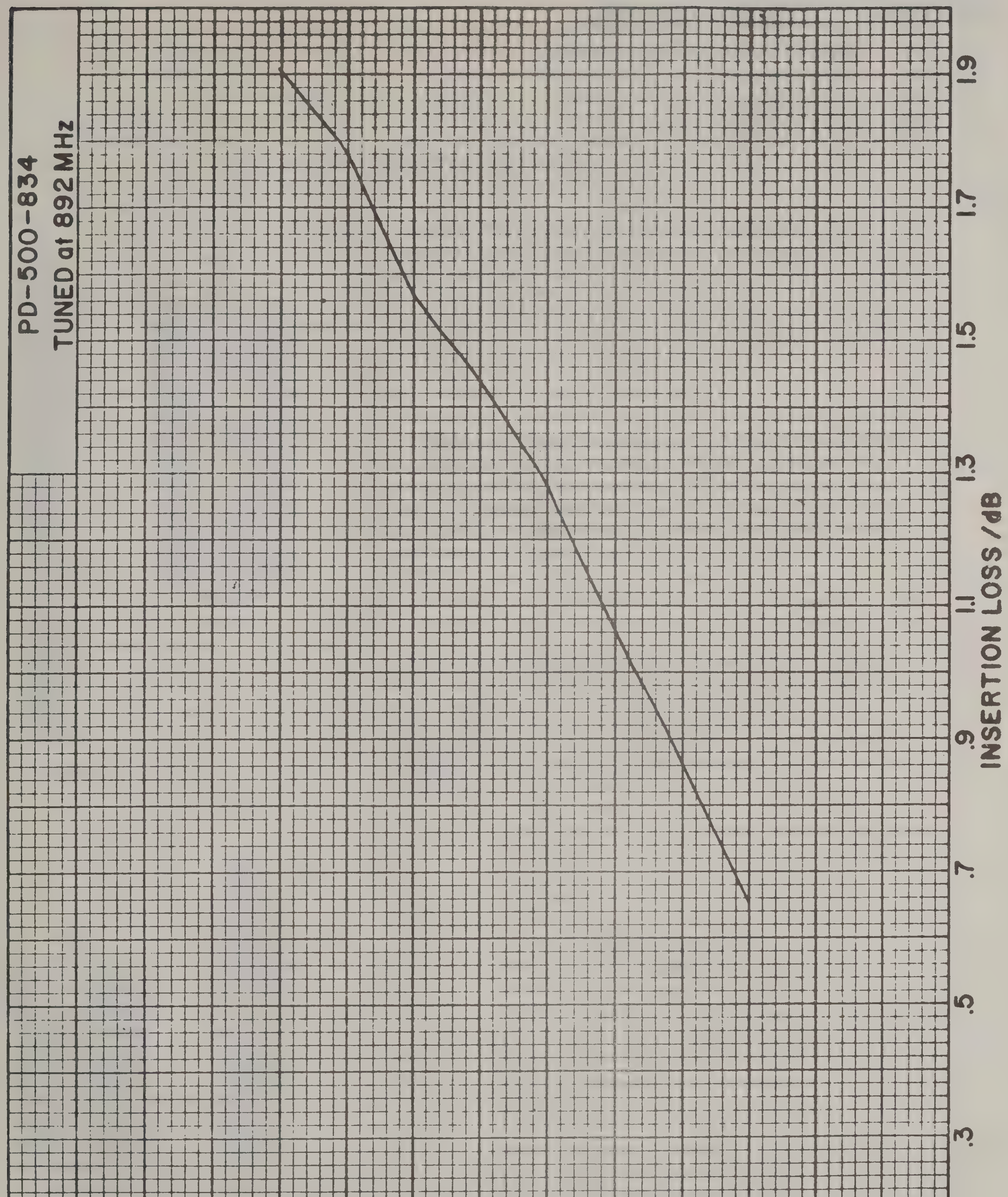
K•E 5 X 5 TO THE ½ INCH 359-6
KEUFFEL & ESSER CO. MADE IN U.S.A.



K•Σ 5 X 5 TO THE ½ INCH 359-6
KEUFFEL & ESSER CO. MADE IN U.S.A.



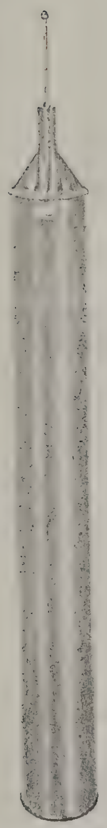
K+E 5 X 5 TO THE ½ INCH 359-6
KEUFFEL & ESSER CO. MADE IN U.S.A.



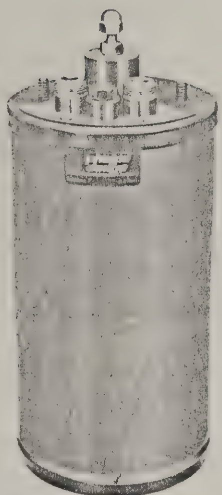
Pass-Reject Cavity

66-88, 136-174, 406-512 MHz	PD-505
406-512 MHz	PD-695
806-896 MHz	PD-895
406-512 MHz	PD-1155

Exact frequencies must be specified.



PD-505



PD-695

PD-505 Pass Reject Dual Notch Resonators are designed to pass one frequency and reject another on either side of their pass frequency. (For minimum spacing see table Page 14), the 505 series of pass-notch devices are of copper construction and are 6 inch diameter quarter-wave resonators. The 505 series is temperature compensated for operation over the range of −40° to +160°F.

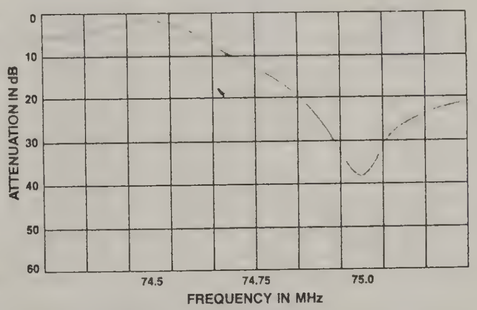
PD-695 and PD-895 Pass Reject Dual Notch Resonators are designed to pass one frequency and reject another on either side of their pass frequency (For minimum spacing see page 14), the resonators are of copper construction and are 4 inch diameter quarter-wave resonators. The PD-895 is temperature compensated for operation over the range of −40° to +160°F.

PD-1155 Pass Reject Dual Notch Resonator is designed to pass one frequency and reject another on either side of its pass frequency. The PD-1155 will operate at a minimum spacing of 500 KHz. The PD-1155 cavity is of copper construction and is a 6 inch diameter, three quarter-wave coaxial resonator. The operating temperature range is −40° to +160°F.

PD-895

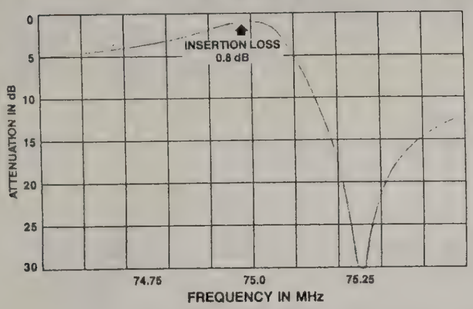
PD-1155

PD-505 -0 RESPONSE CURVE
0.500 MHz SPACING
(66-88 MHz)

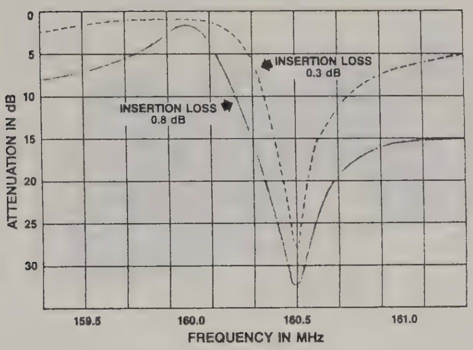


25
MHz
66
88
136
174
406
512
806
896
960
MHz

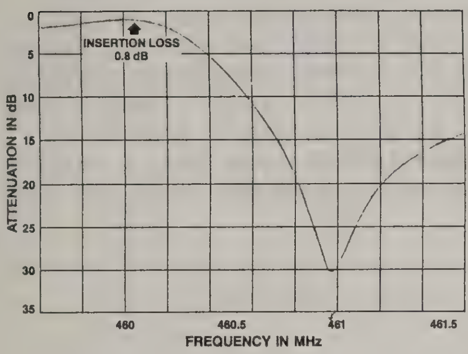
PD-505-0 RESPONSE CURVE
.250 MHz SPACING
(66-88 MHz)



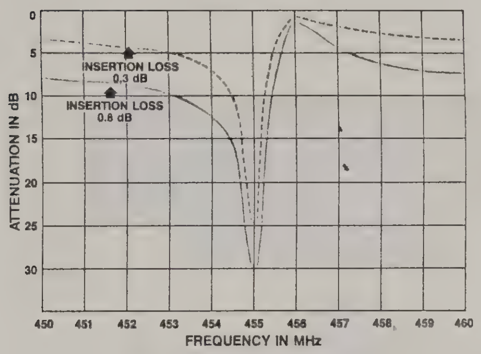
PD-505-1 RESPONSE CURVES
(136-174 MHz)



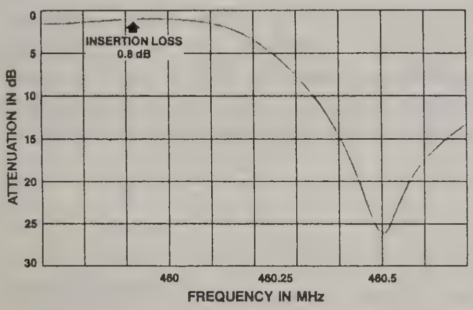
PD-505-4 RESPONSE CURVE
(406-512 MHz)



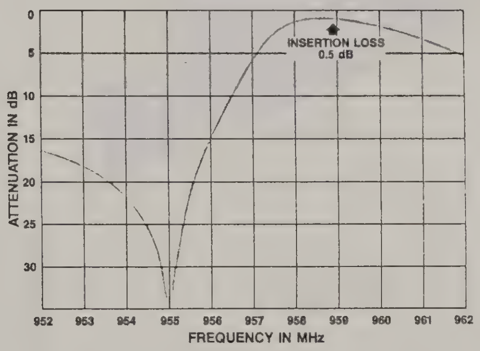
PD-695 RESPONSE CURVES
(406-512 MHz)



PD-1155 RESPONSE CURVE
(406-512 MHz)



PD-895 RESPONSE CURVE
(806-896 MHz)



Electrical Specifications:	**PD-505-0**		**PD-505-1**		**PD-505-4**		**PD-695**		**PD-895**	**PD-1155**	
Frequency Range—MHz	66-88		136-174		406-512		406-512		806-896	406-512	
Insertion Loss—dB	.3	.8	.3	.8	.3	.8	.3	.8	.5	.6	.8
Reject Attenuation—dB	27	24	27	24	27	24	24	24	33	30	24
Min. Frequency Spacing—MHz	.5	.25	.5	.25	2	1	2	1	3.6	1	.5
Max. Power Handling—Watts	400		400		350		250		100	350	
Connector Type (Female)	UHF		UHF		N		N		N	N	
Frequency Stability ppm/°F	0.5		0.5		0.5		0.5		0.5	0.5	

Mechanical Specifications:	**PD-505-0**	**PD-505-1**	**PD-505-4**	**PD-695**	**PD-895**	**PD-1155**
Maximum Dimensions in. (mm) Diameter—in. (mm)	6 (152.4)	.6 (152.4)	6 (152.4)	4 (101.6)	4 (101.6)	6 (152.4)
Length—in. (mm)	70 (1778)	33 (838.2)	15 (381)	13 (330.2)	10 (254)	33 (838.2)
Weight—in. (mm)	15 (6.8)	9 (4.1)	6 (2.7)	4 (1.8)	3½ (1.65)	9 (4.1)

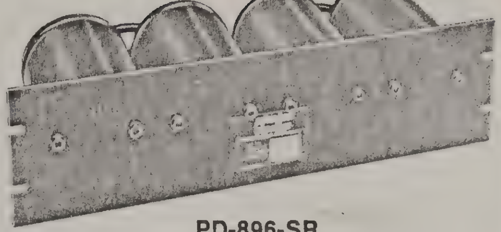
800 MHz Base Station Duplexers

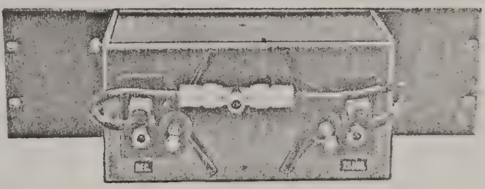
806-960 MHz PD-896
806-960 MHz PD-898

25 MHz

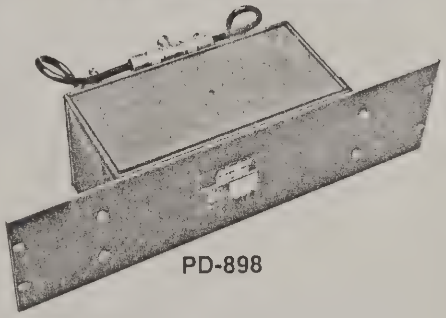
PD-896 Base Station Duplexer uses two of the PD-895 pass-reject dual notch cavities in each channel. Each cavity incorporates a unique loop structure which provides a minimum number of cable-to-connector joints and the simplest harnessing arrangement. The dual notch circuitry provides a pseudo bandpass characteristic, particularly at wider frequency spacings. The PD-896 Duplexer is designed for the 3.6 MHz spacing used in the 956-960 MHz band but can be used at spacings up to 45 MHz.

This duplexer is mounted on a 5¼ inch panel. It may be modified to have the connections in the rear with a flat panel in front. Specify PD-896-SR, as illustrated.


PD-896-SR



PD-898 Base Station Duplexer is specifically designed for use in 45 MHz spaced repeater systems operating in the 806-960 MHz band. It provides a minimum of 65 dB isolation between transmitter and receiver and 1.0 dB maximum insertion loss per channel. The PD-898 features copper construction and is temperature compensated over a wide range. This unit mounts directly in a standard 19 inch rack and is supplied with Type N female terminations.


PD-898

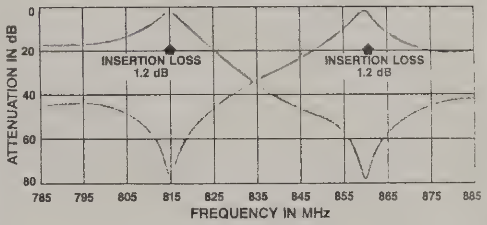
Electrical Specifications	PD-896	PD-898
Frequency Range—MHz	806-960	806-960
Frequency Separation—MHz	3.6 or more	45
Max. Power Input—watts	100	125
Insertion Loss Tx-Ant.—dB	1.2	1.0
Insertion Loss Rx-Ant.—dB	1.2	1.0
Tx Noise Suppression at Rx Freq.—dB	70	65
Rx Isolation at Tx Freq.—dB	70	65
Maximum VSWR	1.3:1	1.5:1
Connector Type (female)	N	N
Frequency Stability ppm/°F	0.5	0.5
Temperature Range	−40 to +160°F	−40 to +160°F

806

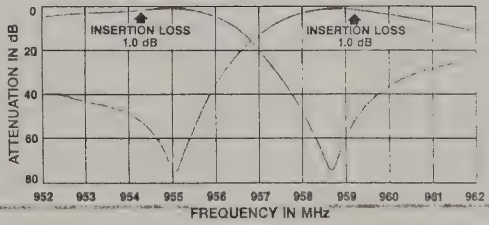
Mechanical Specifications	PD-896	PD-898
Maximum Dimension—in. (mm)		
Height	5¼ (133.3)	5¼ (133.3)
Width	19 (482.6)	19 (482.6)
Depth	9 (228.6)	10 (254)
Weight—lbs. (kg)	23 (10.5)	10 (4.5)

960 MHz

PD-898 RESPONSE CURVES
(806-960 MHz)



PD-896 RESPONSE CURVES
(806-960 MHz)



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Communications Company Route 79 Marlboro New Jersey 07746 • (201) 462-1880

INSTRUCTION BOOK

FOR

CAT. NO. 644-509 (30 – 39 MHz)
CAT NO 645-509 (39 – 50 MHz)

CAVITY RESONATORS

SERIAL NO. 13723
FREQUENCY 35.24

DESCRIPTION

The 644-509 and 645-509 cavity resonators are designed for band-pass applications requiring high selectivity. They are capacitively tuned TEM mode resonators employing capacitive probe coupling, which allows easy adjustment of the insertion loss and thus the selectivity, by the customer.

Complete specifications are given in Fig. 1.

PROBE LENGTH ADJUSTMENT

Refer to the cutting charts for the coupling probes given in Figs. 2 & 3. The probes are supplied in a length giving 0.5 dB insertion loss at the lowest frequency of the given range. Pick the desired operating frequency on the appropriate figure, Fig. 2 for 644-509, Fig. 3 for 645-509. Follow the frequency line up to the intersection with the desired insertion loss line and read across to the length dimension. The length is measured as shown in the figure. The coupling probes should then be reinserted in the resonators.

TUNING INSTRUCTIONS

Fig. 4 shows the tuning set-ups to be employed for both receiver and transmitter applications. For receiver applications a signal generator and the receiver to be used with the resonator will be required. The resonator is merely tuned for maximum signal into the receiver using limiter current readings or other output indicators. The generator level should of course be kept low to minimize receiver overload.

For rough tuning the 1/4-28 set screws in the hexagonal tuning nut should be loosened to allow the tuning rod to be adjusted for a rough indication of resonance. The set screws should then be again tightened to secure the tuning rod. Then the large locknut may be loosened to permit a final fine tuning adjustment with the large screw.

For transmitter application a reduced power output setting of the transmitter, a wattmeter capable of reading both forward and reflected power and a 50 ohm load will be required. With the transmitter keyed the resonator should be quickly tuned for minimum reflected power indication at the input side of the resonator. This adjustment may have to be corrected slightly when connected into an antenna system.

INSTALLATION

The resonators may be used in either a vertical or horizontal position, but in either case they should be secured to prevent their becoming damaged or detuned. They should not be operated in excess of the recommended power levels or damage to the resonators and/or the associated transmitter might be the result.

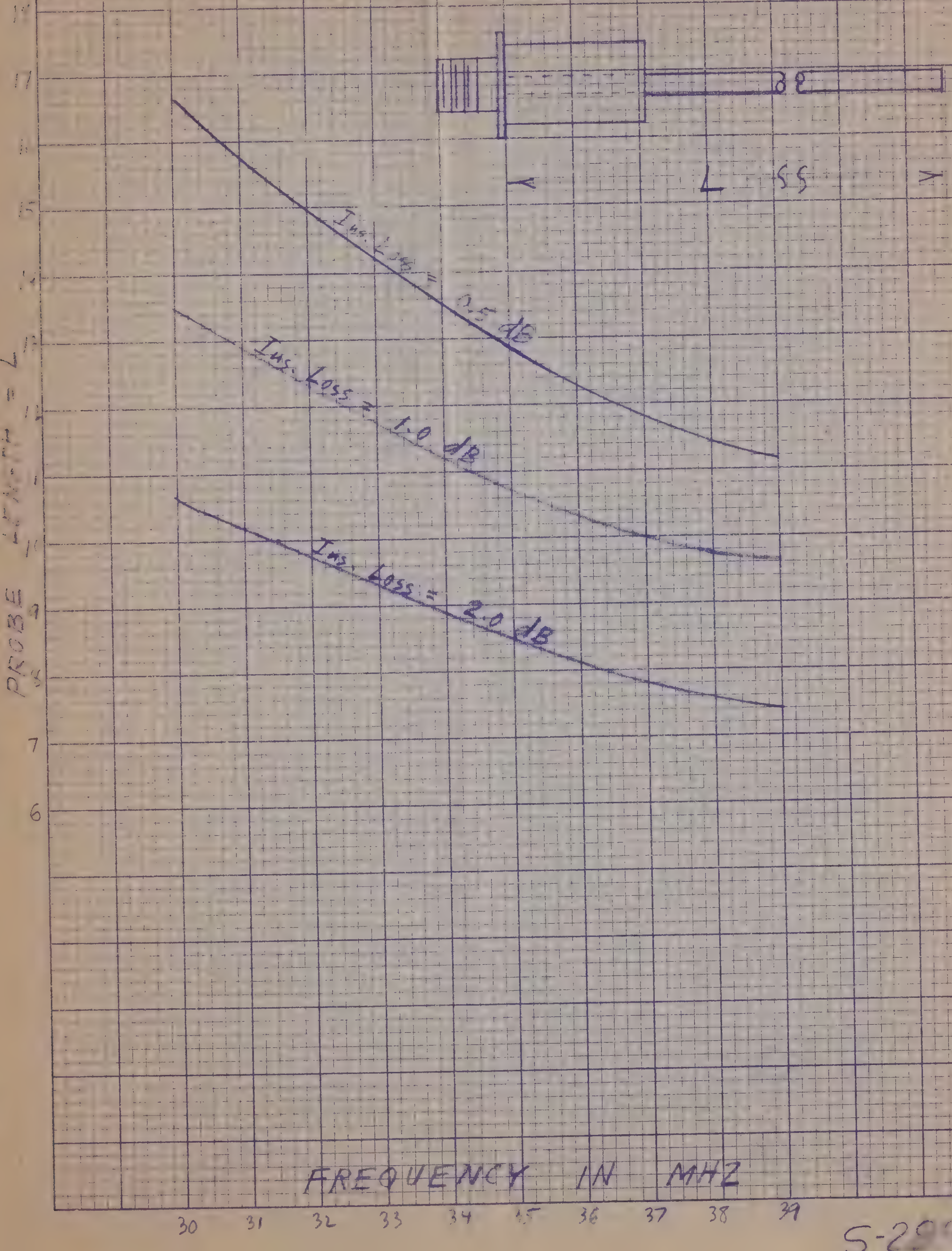
FIG. 1

LOW BAND RESONATOR SPECIFICATIONS

MODEL	644-509	645-509
Frequency Range	30 - 39 MHz	39 - 50 MHz
Insertion Loss	0.5 to 2 dB	0.5 to 2 dB
Attenuation (off Freq.)	-3 dB @ ± 37 KHz	-3 dB @ ± 42 KHz
(with 1 dB insertion Loss)	-10 dB @ ± 135 KHz	-10 dB @ ± 150 KHz
	-20 dB @ ± 375 KHz	-20 dB @ ± 420 KHz
	-30 dB @ ± 1.25 MHz	-30 dB @ ± 1.4 MHz
	-40 dB @ ± 3.5 MHz	-40 dB @ ± 3.7 MHz
Impedance	50Ω	50Ω
VSWR at Resonance (Maximum)	1.5 to 1	1.5 to 1
Max. Power Input with insertion loss at:		
0.5 dB	350 watts	350 watts
1.0 dB	125 watts	125 watts
2.0 dB	50 watts	50 watts
Outer Conductor Material	5052 Alum.	5052 Alum.
Inner Conductor Material	Copper	Copper
End Plates	6061-T6 Alum.	6061-T6 Alum.
Cavity Diameter	12"	12"
Maximum Length	89.5"	72"
Net Weight	40 lbs.	36 lbs.
Shipping Weight	66 lbs.	60 lbs.

FIGURE 2

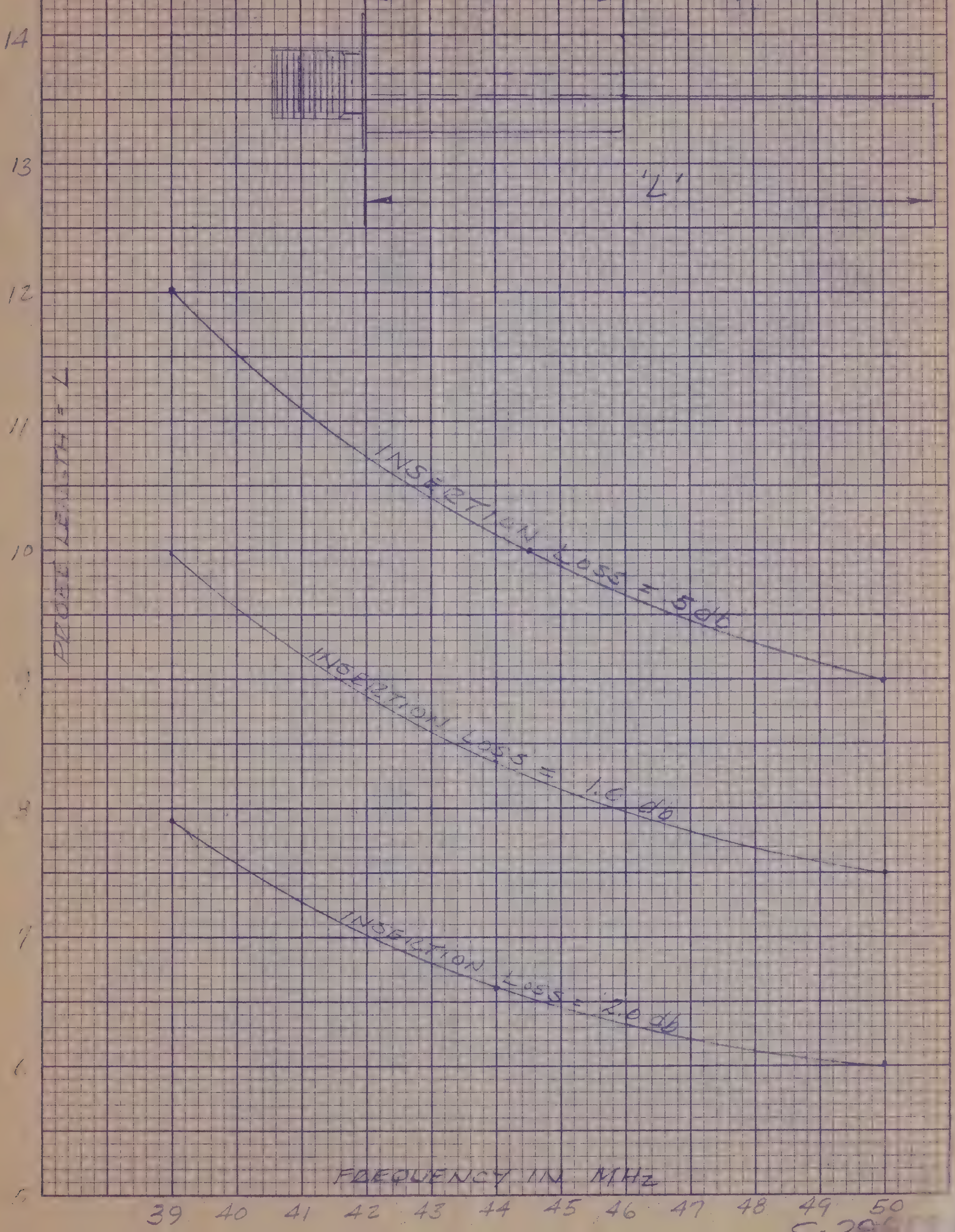
PROBE LENGTH VS. FREQUENCY AT INSERTION LOSSES OF .5, 1.0, & 2.0 dB



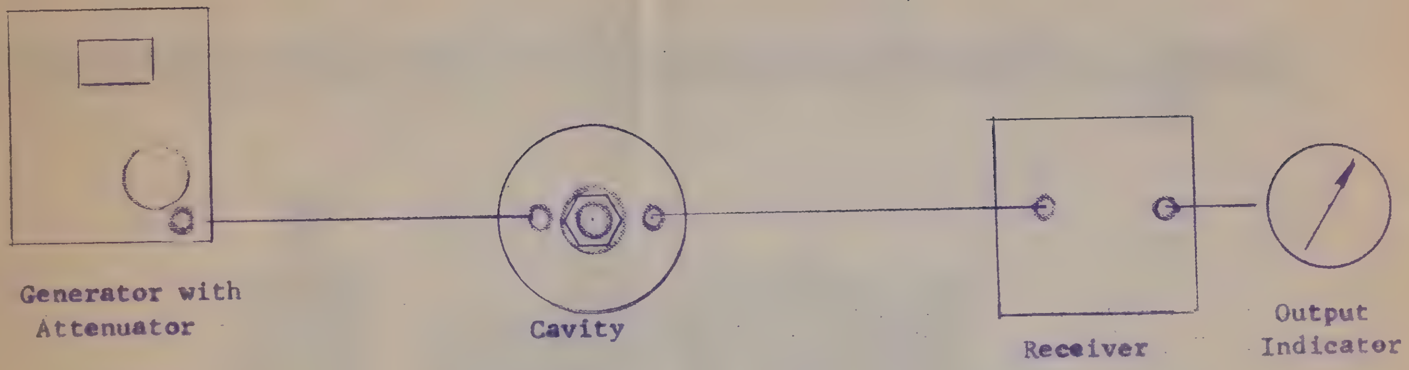
K+E 5 X 5 TO ½ INCH 46 0863
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

FIGURE 3

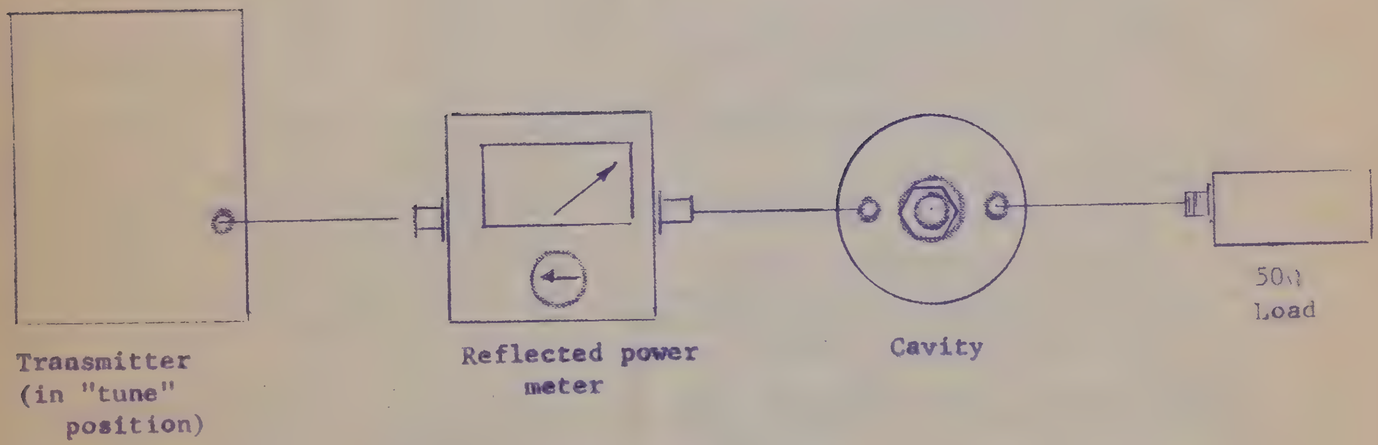
PROBE LENGTH VS FREQ. AT INSERTION LOSSES OF .5, 1.0, & 2.0 dB.



K&E 5 X 5 TO 1/2 INCH 7 X 10 INCHES KEUFFEL & ESSER CO. 46 0863 MADE IN U.S.A.



RECEIVER APPLICATION

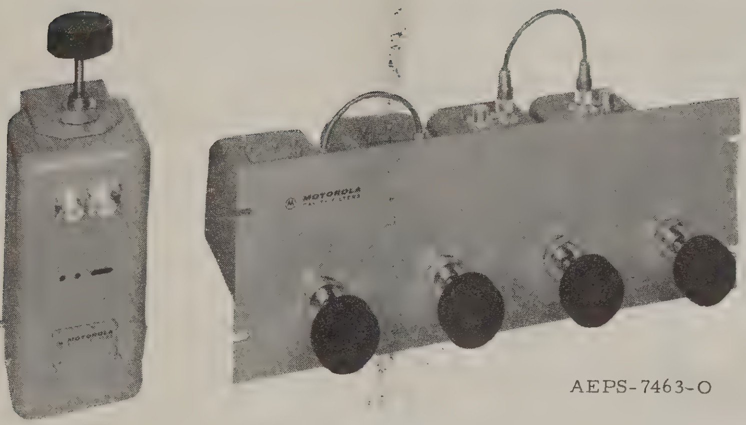


TRANSMITTER APPLICATION

FIG 4

FILTERS AND DUPLEXERS

T1500A SERIES
406-512 MHz


AEPS-7463-O

1. INTRODUCTION

These filters and duplexers are for use with Motorola FM two-way radio communications equipment operating in the 406-512 MHz frequency range. The filters and duplexers use 1/4-wave cavity resonators which are temperature-compensated and tuned with an adjustable center conductor. The cavities contain unique loops or probes terminated in type UHF receptacle connectors with "Teflon" insulation.

These units may be used in the antenna circuit of a base station or repeater to eliminate or minimize receiver desensitization or intermodulation from strong local signals. Similarly, they may be used to reduce transmitter noise or intermodulation products.

2. INSTALLATION

a. Bracket-Mounted Filters

(1) Carefully unpack the unit and check for concealed damage.

(2) Select a mounting location near the associated equipment or inside the equipment cabinet that will permit using the shortest cabling between the filter and the equipment.

(3) Using the mounting bracket as a template, mark the locations of the desired mounting holes.

(4) Drill the mounting holes required by the type of mounting hardware to be used.

(5) Mount the filter using hardware supplied.

MOTOROLA INC.
Communications Division

service publications
1301 E. Algonquin Road, Schaumburg, IL 60196

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PERFORMANCE SPECIFICATIONS

FILTERS

MODEL NUMBER	T1500A			T1501AL, AH			T1502A		
FREQUENCY BAND	406-512 MHz			406-430 MHz	430-470 MHz	470-512 MHz	406-430 MHz	430-470 MHz	470-512 MHz
INSERTION LOSS	0.5 dB	1.0 dB	2.5 dB	0.7 dB	0.6 dB	0.5 dB	1.5 dB	1.3 dB	1.2 dB
LOADED Q	350	725	1750	350			350		
MAXIMUM POWER INPUT	250 W	125 W	60 W	250 W			250 W		
MINIMUM PASS-REJECT SEPARATION				2 MHz		3 MHz	±2 MHz		±3 MHz
MINIMUM REJECT ATTENUATION				37 dB @ 2 MHz 52 dB @ 5 MHz		40 dB @ 3 MHz 48 dB @ 5 MHz	50 dB @ 2 MHz 72 dB @ 5 MHz		54 dB @ 3 MHz 67 dB @ 5 MHz
TEMPERATURE RANGE	-30° C to +60° C			-30° C to +60° C			-30° C to +60° C		
SIZE	12" x 4-1/2" x 5"			12" x 4-1/2" x 5"			7" x 19" x 12"		
TERMINATION	UHF Female			UHF Female			UHF Female		

MODEL NUMBER	T1505A	T1506A
INSERTION LOSS	1.0 - 5.0 dB	1.5 - 7.5 dB
SIZE (H x W x D)	5-1/4" x 19" x 12"	7" x 19" x 12"
POWER INPUT	250 watts - 60 watts (depending on insertion loss)	
ISOLATION (WHEN USED AS DUPLEXER)	See Isolation Curve: Figure 16	
TEMPERATURE RANGE	-30°C to +60°C	
TERMINATION	UHF Female	

DUPLEXERS

MODEL NUMBER	T1503A, AF		T1504A, AF			T1507A
FREQUENCY BAND	406-430 MHz	430-470 MHz	406-430 MHz	430-470 MHz	470-512 MHz	406-512 MHz
MINIMUM FREQUENCY SEPARATION	5 MHz		2 MHz		3 MHz	5 MHz
RECEIVER ISOLATION AT TRANSMIT FREQUENCY	55 dB		80 dB		85 dB	55 dB
TRANSMITTER NOISE SUPPRESSION AT RECEIVE FREQUENCY	55 dB		80 dB		85 dB	55 dB
MINIMUM TRANSMITTER RECEIVER ISOLATION	45 dB		60 dB		70 dB	55 dB
RECEIVER INSERTION LOSS	0.8 dB	0.7 dB	1.6 dB	1.4 dB	1.3 dB	2.0 dB
TRANSMITTER INSERTION LOSS	0.8 dB	0.7 dB	1.6 dB	1.4 dB	1.3 dB	2.0 dB
VSWR MAXIMUM	1.5: 1		1.5: 1			1.5: 1
MAXIMUM POWER INPUT	250 W		250 W			125 W
TEMPERATURE RANGE	-30°C to +60°C		-30°C to +60°C			-30°C to +60°C
SIZE	7" x 19" x 12"		7" x 19" x 12"			7" x 19" x 12"
TERMINATION	UHF Female		UHF Female			UHF Female

MOTOROLA

MODEL CHART
FOR
FILTERS AND DUPLEXERS
406-512 MHz

CODE:

X = ONE ITEM SUPPLIED.

2 = NUMBER INDICATES QUANTITY OF ITEMS SUPPLIED.

⧄ =ONE ITEM SUPPLIED WHEN FREQUENCY SPACING IS LESS THAN 5.0 MHz

◪ = ONE ITEM SUPPLIED WHEN FREQUENCY SPACING IS GREATER THAN 5.0 MHz

O = TWO ITEMS SUPPLIED WHEN FREQUENCY SPACING IS LESS THAN 5.0 MHz

■ = TWO ITEMS SUPPLIED WHEN FREQUENCY SPACING IS GREATER THAN 5.0 MHz

MODEL	DESCRIPTION	CAVITY FILTER KIT	PASSBAND COUPLING LOOP KIT	COUPLING LOOP KIT	COUPLING PROBE KIT	CABLE KIT	CABLE KIT	CABLE KIT	CABLE KIT	CABLE KIT	CABLE KIT	CABLE KIT	MOUNTING BRACKET KIT	RACK PANEL KIT	MISCELLANEOUS PARTS KIT	MISCELLANEOUS PARTS KIT	COUPLING LOOP KIT
KIT	470-512 MHz	TLE6420A	TLE6883A	TLE6432A	TLE6433A	TKN6537A	TKN6540A	TKN6543A	TKN6546A	TKN6551A	TKN6431A	TKN6432A	TLN4031A	TLN4066A	TLN4104A	TLN4202A	TLE6434A
KIT	430-470 MHz	TLE6420A	TLE6882A	TLE6432A	TLE6433A	TKN6536A	TKN6539A	TKN6542A	TKN6545A	TKN6550A	TKN6431A	TKN6432A	TLN4031A	TLN4066A	TLN4104A	TLN4202A	TLE6434A
KIT	406-430 MHz	TLE6420A	TLE6881A	TLE6432A	TLE6433A	TKN6535A	TKN6538A	TKN6541A	TKN6544A	TKN6549A	TKN6431A	TKN6432A	TLN4031A	TLN4066A	TLN4104A	TLN4202A	TLE6434A
T1500A	PASSBAND CAVITY FILTER	X	X										X				
T1501AH	PASS-REJECT CAVITY FILTER (REJECT FREQUENCY HIGHER THAN PASS FREQUENCY)	X		⧄									X				◪
T1501AL	PASS-REJECT CAVITY FILTER (REJECT FREQUENCY LOWER THAN PASS FREQUENCY)	X			X								X				
T1502A	TWO-CAVITY PASS-REJECT FILTER	2		⧄	X	X								X			◪
T1503A	TWO-CAVITY PASS-REJECT DUPLEXER	2		⧄	X		X							X	X		◪
T1503AF	FACTORY INSTALLED TWO-CAVITY PASS-REJECT DUPLEXER	2		⧄	X		X				2	2		X		X	◪
T1504A	FOUR-CAVITY PASS-REJECT DUPLEXER	4		O	2			X						X	X		■
T1504AF	FACTORY INSTALLED FOUR-CAVITY PASS-REJECT DUPLEXER	4		O	2			X			2	2		X		X	■
T1505A	TWO-CAVITY PASSBAND FILTER	2	2						X					X			
T1506A	THREE-CAVITY PASSBAND FILTER	3	3						2					X			
T1507A	FOUR-CAVITY PASSBAND DUPLEXER	4	4							X				X		X	
T1507AF	FACTORY INSTALLED FOUR-CAVITY PASSBAND DUPLEXER	4	4							X				X		X	

(6) Connect the filter to the transmitter or receiver. Cables external to the filter are not of a critical length and may be shortened if required.

b. Rack Panel Mounted Units

(1) Carefully unpack the unit and check for concealed damage.

(2) The units are designed to mount on any standard 19-inch relay rack. Hardware is supplied for mounting units into Motorola outdoor base station cabinets.

(3) Select position in rack for best location of unit, i.e., closest proximity to associated equipment inputs and outputs.

(4) Mount unit in place in rack with appropriate mounting hardware. The hardware supplied is intended for use with Motorola base stations.

(5) Connect the filter and duplexer to the transmitter and receiver.

(6) Duplexers and filters must be installed with appropriate lengths of 50 ohm coaxial cable (not supplied) to fit the individual installation.

3. THEORY OF OPERATION

Each resonant cavity, technically a re-entrant quarter-wave resonator, is a very high-Q (low-loss) tunable tank circuit. The dimensions of each resonator are designed for minimum loss. The cavities are tuned to the required pass frequency by an adjustment which changes the length of the center conductor. Lower frequencies have more of the center conductor inside the cavity, higher frequencies have correspondingly less. Invar, a material with a very low temperature coefficient of expansion, is used for the tuning shaft to minimize detuning due to ambient temperature changes.

Each resonant cavity is fitted with a specially designed pair of coupling elements (loops or probes). These loops and probes efficiently convert energy from the 50 ohm coaxial cable to the correct mode inside the resonant structure.

When the cavity is not tuned to resonance, most of the energy is reflected. Only a small portion is able to excite the correct mode and reach the output element.

a. Passband Filters

Each passband cavity filter is provided with a set of adjustable coupling loops to supply varying degrees of selectivity. Coupling loop positions which provide a higher degree of selectivity also result in a higher insertion loss.

b. Pass-Reject Filters and Duplexers

The input and output coupling elements are placed very close to each other, to take advantage of mutual coupling. That is, a small amount of energy is always being transferred between coupling elements because of their proximity. At one frequency, the energy transferred by mutual coupling cancels the energy transferred across by the resonant mode within the cavity. Thus, at one frequency, there is a reject notch in addition to the selectivity of the cavity. When coupling loops are used, the notch occurs above the pass frequency; when coupling probes are used, the notch is below the pass frequency. The notch frequency is adjusted by changing the physical spacing between the coupling elements.

Cavities are used on each side of a duplexer. The cavities tuned to the lower carrier frequency use the coupling loops to notch out the higher carrier frequency, while the cavities tuned to the higher carrier frequency use coupling probes to notch out the lower carrier frequency. Odd quarter-wave coupling is used between cavities to obtain minimum pass frequency bandwidth and insertion loss.

4. INSTALLATION OF COUPLING ELEMENTS

Coupling elements are factory-installed in all T1500A Series Cavity Filters and Duplexers. There are three coupling element types: passband loops, notch loops, and notch probes (refer to Figures 2, 3, and 4). If it becomes necessary to change or install coupling elements, use the following procedure.

a. Passband Coupling Loops (Kits TLE6881A, TLE6882A and TLE6883A)

Models T1500A, T1505A, T1506A and T1507A employ passband loops. Unless otherwise specified on the factory order, the loops will be set for 1/2 dB insertion loss. The loops in the T1507A duplexer will be set for 1.0 dB.

Insertion loss of the filter is determined by the position in which the coupling loops are installed

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

TLN4066A Mounting Panel Kit PL-391-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	64-84242A03	PANEL, cavity mtg
	3-135038	SCREW, tapping: No. 14 x 3/4" Phillips pan head (4 req'd)
	2-82360B07	NUT, sheet spring: ("clip-on"); type "U" (4 req'd)
	4-812732	WASHER, cushion (4 req'd)
	66-106514	WRENCH, ALLEN (#8)
	33-84333B01	NAMEPLATE
	7-82537N01	BRACKET, duplexer cable
	42-10217A01	STRAP, tie

TLN4104A and TLN4202A Miscellaneous Parts Kit PL-392-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	9-86150	CONNECTOR, adapter: uhf; "tee" type
	58-109152	CONNECTOR, adapter: uhf; "feed-through" type
	28-82021G01	CONNECTOR, plug: male; uhf; 4 req'd. (TLN4104A only)

(6) Connect the filter to the transmitter or receiver. Cables external to the filter are not of a critical length and may be shortened if required.

b. Rack Panel Mounted Units

(1) Carefully unpack the unit and check for concealed damage.

(2) The units are designed to mount on any standard 19-inch relay rack. Hardware is supplied for mounting units into Motorola outdoor base station cabinets.

(3) Select position in rack for best location of unit, i.e., closest proximity to associated equipment inputs and outputs.

(4) Mount unit in place in rack with appropriate mounting hardware. The hardware supplied is intended for use with Motorola base stations.

(5) Connect the filter and duplexer to the transmitter and receiver.

(6) Duplexers and filters must be installed with appropriate lengths of 50 ohm coaxial cable (not supplied) to fit the individual installation.

3. THEORY OF OPERATION

Each resonant cavity, technically a re-entrant quarter-wave resonator, is a very high-Q (low-loss) tunable tank circuit. The dimensions of each resonator are designed for minimum loss. The cavities are tuned to the required pass frequency by an adjustment which changes the length of the center conductor. Lower frequencies have more of the center conductor inside the cavity, higher frequencies have correspondingly less. Invar, a material with a very low temperature coefficient of expansion, is used for the tuning shaft to minimize detuning due to ambient temperature changes.

Each resonant cavity is fitted with a specially designed pair of coupling elements (loops or probes). These loops and probes efficiently convert energy from the 50 ohm coaxial cable to the correct mode inside the resonant structure.

When the cavity is not tuned to resonance, most of the energy is reflected. Only a small portion is able to excite the correct mode and reach the output element.

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The input and output coupling elements are placed very close to each other, to take advantage of mutual coupling. That is, a small amount of energy is always being transferred between coupling elements because of their proximity. At one frequency, the energy transferred by mutual coupling cancels the energy transferred across by the resonant mode within the cavity. Thus, at one frequency, there is a reject notch in addition to the selectivity of the cavity. When coupling loops are used, the notch occurs above the pass frequency; when coupling probes are used, the notch is below the pass frequency. The notch frequency is adjusted by changing the physical spacing between the coupling elements.

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Models T1500A, T1505A, T1506A and T1507A employ passband loops. Unless otherwise specified on the factory order, the loops will be set for 1/2 dB insertion loss. The loops in the T1507A duplexer will be set for 1.0 dB.

Insertion loss of the filter is determined by the position in which the coupling loops are installed

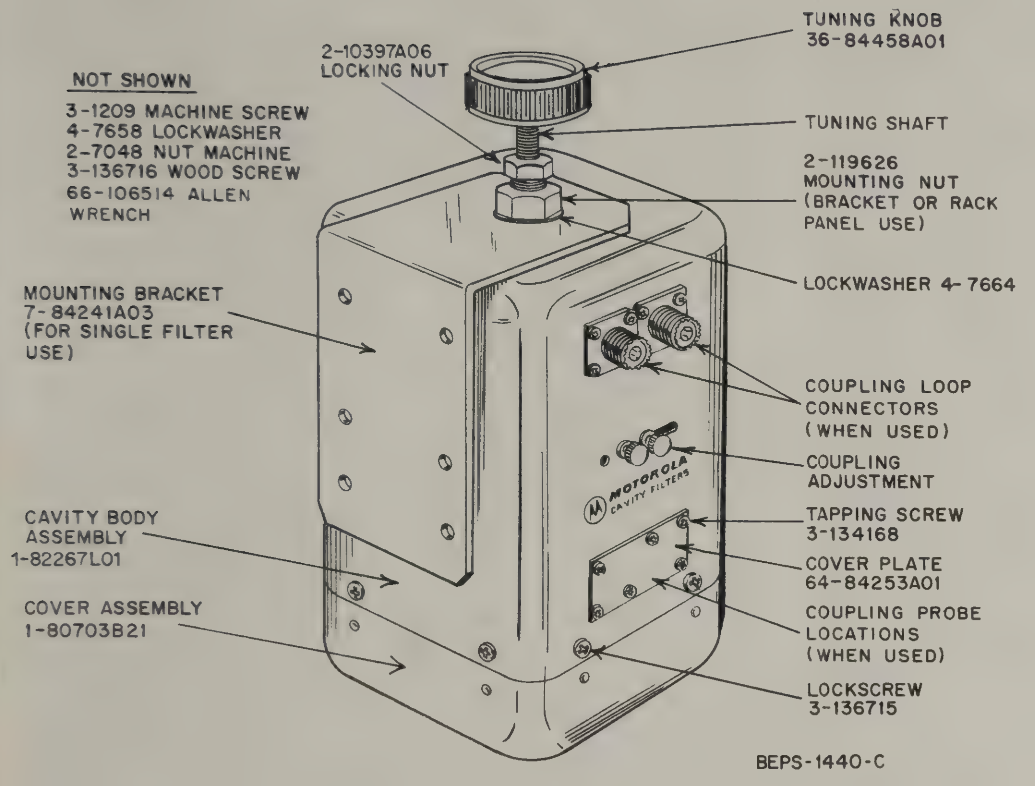


Figure 1.
Cavity Filter Parts Location Detail

PARTS LIST

TLE6420A Filter Cavity PL-385-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	1-82267L01	CAVITY BODY ASSEMBLY:
	1-80703B21	COVER ASSEMBLY, cavity
	47-84255A01	PLUNGER
	47-84254A03	TUNING SHAFT
	41-84247A01	SPRING
	4-84250A01	WASHER (2 req'd)
	4-84251A01	WASHER
	64-84253A01	COVER PLATE, hole
	3-400356	SCREW, tapping: 4-24 x 1/4"; plain hex head; 6 req'd
	3-3375	SCREW, tapping: 6-20 x 5/16"; plain hex head; 8 req'd
	4-9777	LOCKWASHER, split: No. 4; 6 req'd
	2-119626	NUT, machine: 3/4-16 x 1-1/8" hex
	4-7664	LOCKWASHER: 3/4" internal
	36-84458A01	KNOB, tuning
	42-82388C05	RETAINING RING: "E" type
	2-10397A06	NUT, locking: #2-20

TLE6881A Passband Coupling Loop Kit (406-430 MHz) PL-1489-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	1-84448A03	COUPLING LOOP ASSEMBLY: fixed; right hand; coded GRN, RED (used for 1/2 and 1 dB insertion loss)
	1-84448A04	COUPLING LOOP ASSEMBLY: fixed; left hand; coded GRN, RED (used for 1/2 and 1 dB insertion loss)
	1-84448A07	COUPLING LOOP ASSEMBLY: fixed; right hand; coded BLK, GRN (used for 2.5 dB insertion loss)
	1-84448A08	COUPLING LOOP ASSEMBLY: fixed; left hand; coded BLK, GRN (used for 2.5 dB insertion loss)
	3-400356	SCREW, tapping: 4 x 1/4"; hex hd; 8 req'd.
	4-9777	LOCKWASHER, split: No. 4; 8 req'd.

TLE6882A Passband Coupling Loop Kit (430-470 MHz) PL-386-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	1-84448A01	COUPLING LOOP ASSEMBLY: fixed; right hand; coded BLK, RED (used for 1/2 and 1 dB insertion loss)
	1-84448A02	COUPLING LOOP ASSEMBLY: fixed; left hand; coded BLK, RED (used for 1/2 and 1 dB insertion loss)
	1-84448A09	COUPLING LOOP ASSEMBLY: fixed; right hand; coded RED, BLU (used for 2.5 dB insertion loss)
	1-84448A10	COUPLING LOOP ASSEMBLY: fixed; left hand; coded RED, BLU (used for 2.5 dB insertion loss)
	3-400356	SCREW, tapping: 4 x 1/4"; hex head; 8 req'd.
	4-9777	LOCKWASHER, split: No. 4; 8 req'd.

TLE6883A Passband Coupling Loop Kit (470-512 MHz) PL-1490-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	1-84448A05	COUPLING LOOP ASSEMBLY: fixed; right hand; coded BLK, BLU (used for 1/2 and 1 dB insertion loss)
	1-84448A06	COUPLING LOOP ASSEMBLY: fixed; left hand; coded BLK, BLU (used for 1/2 and 1 dB insertion loss)
	1-84448A11	COUPLING LOOP ASSEMBLY: fixed; right hand; coded BLU, GRN (used for 2.5 dB insertion loss)
	1-84448A12	COUPLING LOOP ASSEMBLY: fixed; left hand; coded BLU, GRN (used for 2.5 dB insertion loss)
	3-400356	SCREW, tapping: 4 x 1/4"; hex head; 8 req'd.
	4-9777	LOCKWASHER, split: No. 4; 8 req'd.

TLE6434A Notch Coupling Loop Kit PL-387-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	9-82442E05	CONNECTOR, receptacle: 2 req'd.
	24-84238A01	LOOP, cavity (R.H.)
	24-84238A03	LOOP, cavity (L.H.)
	3-400356	SCREW, tapping: 4 x 1/4"; hex hd.; 8 req'd.
	4-9777	LOCKWASHER, split: No. 4; 8 req'd.
	4-82418B01	WASHER, nylon: 2 req'd.
	4-9746	LOCKWASHER: #8 med. split; 2 req'd.
	3-82245E04	SCREW, knurled head: 2 req'd. (TLE6432A)
	3-2949	SCREW, machine: 6-32 x 5/16" (TLE6434A)

TLE6433A Notch Coupling Probe Kit PL-388-E

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	9-82442E05	CONNECTOR, receptacle: 2 req'd
	24-84239A01	PROBE, adjustable (R.H.)
	24-84239A03	PROBE, adjustable (L.H.)
	3-400356	SCREW, tapping: 4 x 1/4"; hex hd.; 8 req'd.
	4-9777	LOCKWASHER, split: No. 4; 8 req'd.
	14-84240A01	INSULATOR, probe mounting: 2 req'd.
	4-9746	LOCKWASHER: #8 med. split; 2 req'd.
	2-84447A01	NUT, knurled: 2 req'd.
	4-82418B01	WASHER, insulating; 2 req'd.

TLN4031A Mounting Bracket Kit (1-Cavity) PL-389-B

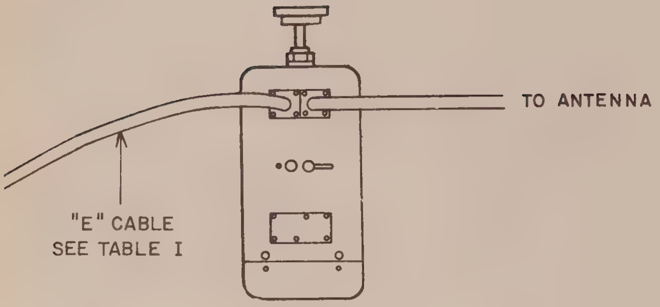
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	7-84241A03	BRACKET, cavity mtg
	3-1209	SCREW, machine: 10-32 x 1/2" slotted binder head (4 req'd)
	4-7658	LOCKWASHER: No. 10 internal (4 req'd)
	2-7048	NUT, machine: 10-32 x 5/16" hex (4 req'd)
	3-136716	SCREW, wood: No. 10 x 1-1/2" slotted round head (4 req'd)
	66-106514	WRENCH, ALLEN (#8)
	33-84002B01	NAMEPLATE, cavity

TLN4066A Mounting Panel Kit PL-391-D

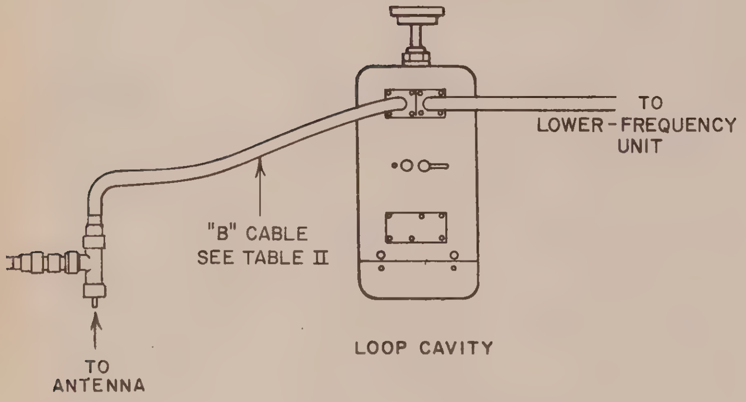
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	64-84242A03	PANEL, cavity mtg
	3-135038	SCREW, tapping: No. 14 x 3/4" Phillips pan head (4 req'd)
	2-82360B07	NUT, sheet spring: ("clip-on"); type "U" (4 req'd)
	4-812732	WASHER, cushion (4 req'd)
	66-106514	WRENCH, ALLEN (#8)
	33-84333B01	NAMEPLATE
	7-82537N01	BRACKET, duplexer cable
	42-10217A01	STRAP, tie

TLN4104A and TLN4202A Miscellaneous Parts Kit PL-392-B

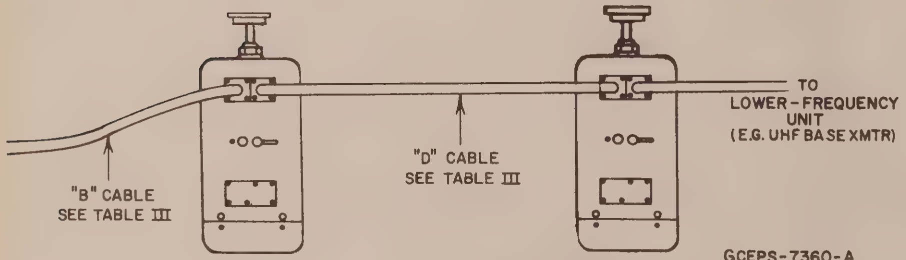
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	9-86150	CONNECTOR, adapter: uhf; "tee" type
	58-109152	CONNECTOR, adapter: uhf; "feed-through" type
	28-82021G01	CONNECTOR, plug: male; uhf; 4 req'd. (TLN4104A only)



LOOP CAVITY



LOOP CAVITY



LOOP CAVITY
(REJECT FREQUENCY HIGHER THAN
PASS FREQUENCY)

GCEPS-7360-A

NA

LOOP CAVITY
(REJECT FREQUENCY HIGHER
THAN PASS FREQUENCY)

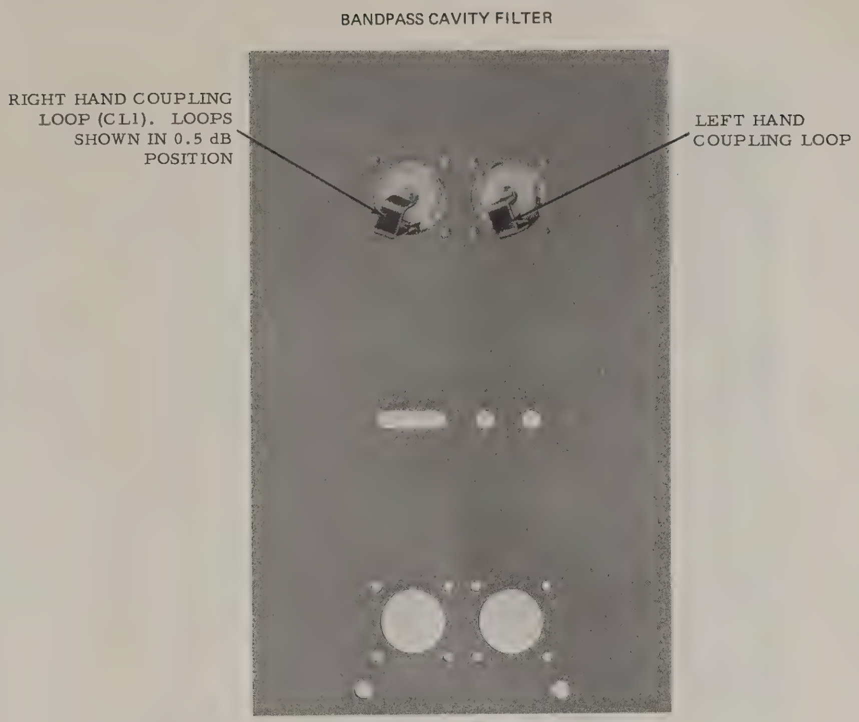

BANDPASS CAVITY FILTER
RIGHT HAND COUPLING LOOP (CL1). LOOPS SHOWN IN 0.5 dB POSITION
LEFT HAND COUPLING LOOP

Figure 2. FAEPS–2623–A
Passband Coupling Loop Kit
(TLE6881A, TLE6882A, & TLE6883A)
(Interior View)

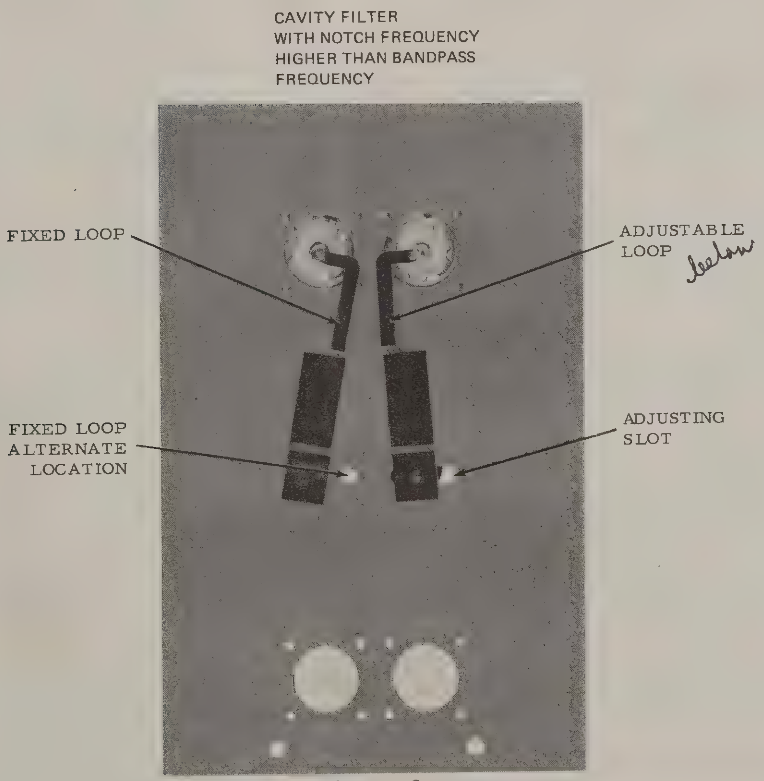

CAVITY FILTER WITH NOTCH FREQUENCY HIGHER THAN BANDPASS FREQUENCY
FIXED LOOP
ADJUSTABLE LOOP
yellow
FIXED LOOP ALTERNATE LOCATION
ADJUSTING SLOT

Figure 3. FAEPS–2624–A
TLE6432A (Loops Coded YEL, BLU)
TLE6434A (Loops Coded GRAY, VIOLET)
Notch Coupling Loop Kit
(Interior View)

CABLE KITS

PL-1491-C

CABLE KIT NUMBER	LOOSE CONNECTORS INCLUDED IN KIT		CABLE ASSEMBLIES INCLUDED IN KIT		ITEMS INCLUDED IN CABLE ASSEMBLY		
	CONNECTOR: COAXIAL; "TEE" TYPE; PART NO. 9-86150 (FOR QUANTITY REQUIRED, SEE BELOW)	CONNECTOR: COAXIAL; FEED-THRU TYPE; PART NO. 58-109152 (FOR QUANTITY REQUIRED, SEE BELOW)	PART NUMBER	COLOR CODE	CABLE, RF: COAXIAL; TYPE RG-142 B/U; PART NO. 30-83278B01 (FOR LENGTH REQUIRED, SEE BELOW)	CONNECTOR, MALE: COAXIAL; UHF TYPE; PART NO. 28-82021G01 (FOR QUANTITY REQUIRED, SEE BELOW)	ADAPTER, CABLE: PART NO. 58-854020 (FOR QUANTITY REQUIRED, SEE BELOW)
TKN6535A	--	--	1-84459A13	BLK, RED	14-1/4"	2	2
TKN6536A	--	--	1-84459A23	BLK	13-3/8	2	2
TKN6537A	--	--	1-84459A19	BRN, GRN	11-3/4"	2	2
TKN6538A	--	--	1-84459A18	BRN, BLU	6-3/8"	2	2
			1-84459A04	ORG	9-3/4"	2	2
TKN6539A	--	--	1-84459A12	RED, YEL	5-3/4"	2	2
			1-84459A06	GRN	8-3/4"	2	2
TKN6540A	--	--	1-84459A05	YEL	5-1/4"	2	2
			1-84459A16	BLK, BLU	8"	2	2
TKN6541A	--	--	1-84459A18	BRN, BLU	6-3/8"	2	2
			1-84459A04	ORG	9-3/4"	2	2
			1-84459A14	BLK, YEL	10-1/2"	2	2
			1-84459A15	BLK, GRN	9-3/8"	2	2
TKN6542A	--	--	1-84459A12	RED, YEL	5-3/4"	2	2
			1-84459A06	GRN	8-3/4"	2	2
			1-84459A04	ORG	9-3/4"	2	2
			1-84459A07	BLU	8-1/2"	2	2
TKN6543A	--	--	1-84459A05	YEL	5-1/4"	2	2
			1-84459A16	BLK, BLU	8"	2	2
			1-84459A15	BLK, GRN	9-3/8"	2	2
			1-84459A20	BRN, YEL	7-7/8"	2	2
TKN6544A	--	--	*1-84459A15	BLK, GRN	9-3/8"	2	2
TKN6545A	--	--	*1-84459A07	BLU	8-1/2"	2	2
TKN6546A	--	--	*1-84459A20	BRN, YEL	7-7/8"	2	2
TKN6549A	--	--	*1-84459A15	BLK, GRN	9-3/8"	2	2
			*1-84459A04	ORG	9-3/4"	2	2
TKN6550A	--	--	*1-84459A07	BLU	8-1/2"	2	2
			*1-84459A06	GRN	8-3/4"	2	2
TKN6551A	--	--	*1-84459A20	BRN, YEL	7-7/8"	2	2
			*1-84459A16	BLK, BLU	8"	2	2
TKN6552A	1	1	*1-84459A16	BLK, BLU	8"	2	2
TKN6553A	1	1	*1-84459A10	VIO	7-3/8"	2	2
TKN6554A	1	1	*1-84459A21	BRN, RED	6-7/8"	2	2
TKN6555A	1	1	*1-84459A17	BRN, GRA	17-3/4"	2	2
TKN6556A	1	1	*1-84459A11	GRA	15-3/4"	2	2
TKN6557A	1	1	*1-84459A22	RED, BLU	14-3/4"	2	2
TKN6558A	1	1	*1-84459A04	ORG	9-3/4"	2	2
TKN6559A	1	1	*1-84459A06	GRN	8-3/4"	2	2
TKN6560A	1	1	*1-84459A16	BLK, BLU	8"	2	2

* (2) SUPPLIED

TABLE I

MODEL T1502A

FREQ. RANGE	CABLE KIT	"E" CODE
406-430 MHz	TKN6535A	BLK-RED
430-470 MHz	TKN6536A	BLACK
470-512 MHz	TKN6537A	BRN-GRN

MODEL T1502A

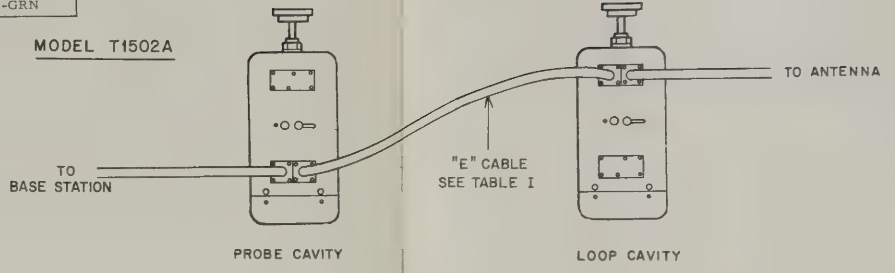


TABLE II

MODEL T1503A

FREQ. RANGE	CABLE KIT	"A" CODE	"B" CODE
406-430 MHz	TKN6538A	BRN-BLU	ORG
430-470 MHz	TKN6539A	RED-YEL	GRN
470-512 MHz	TKN6540A	YEL	BLK-BLU

MODEL T1503A

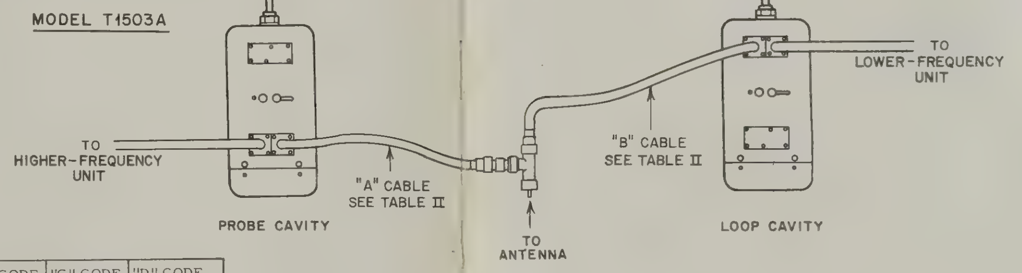
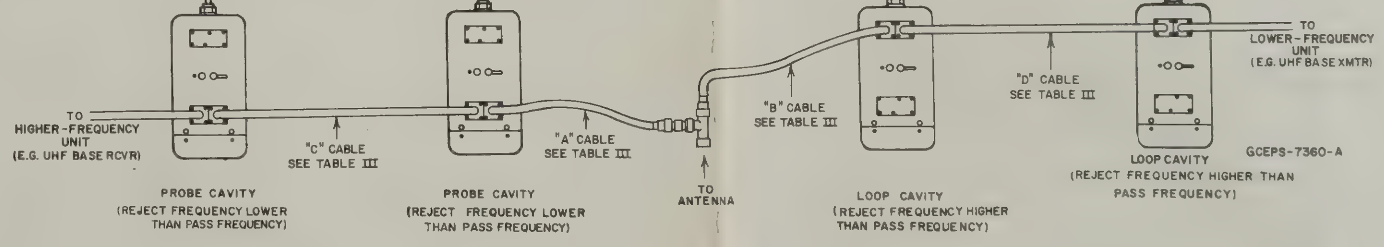


TABLE III

MODEL T1504A

FREQ. RANGE	CABLE KIT	"A" CODE	"B" CODE	"C" CODE	"D" CODE
406-430 MHz	TKN6541A	BRN-BLU	ORG	BLK-YEL	BLK-GRN
430-470 MHz	TKN6542A	RED-YEL	GRN	ORG	BLU
470-512 MHz	TKN6543A	YEL	BLK-BLU	BLK-GRN	BRN-YEL

MODEL T1504A



GCEPS-7360-A

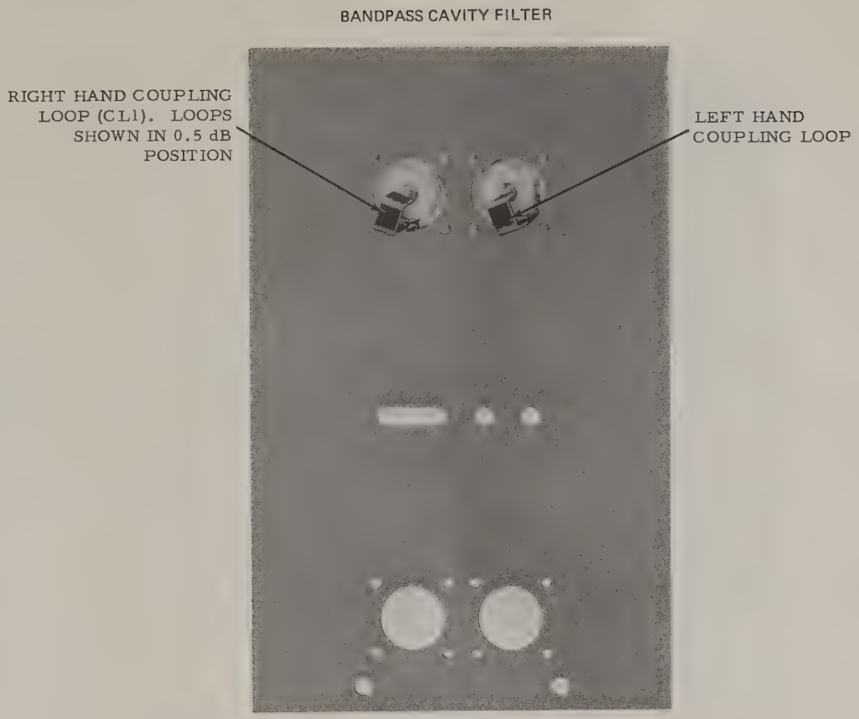

BANDPASS CAVITY FILTER
RIGHT HAND COUPLING LOOP (CL1). LOOPS SHOWN IN 0.5 dB POSITION
LEFT HAND COUPLING LOOP

Figure 2. FAEPS–2623–A
Passband Coupling Loop Kit
(TLE6881A, TLE6882A, & TLE6883A)
(Interior View)

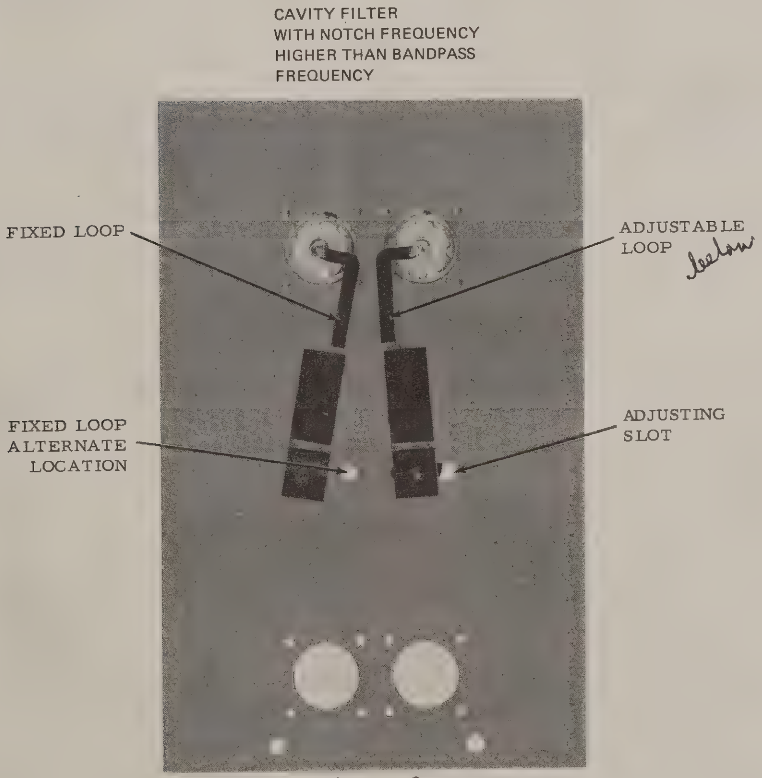
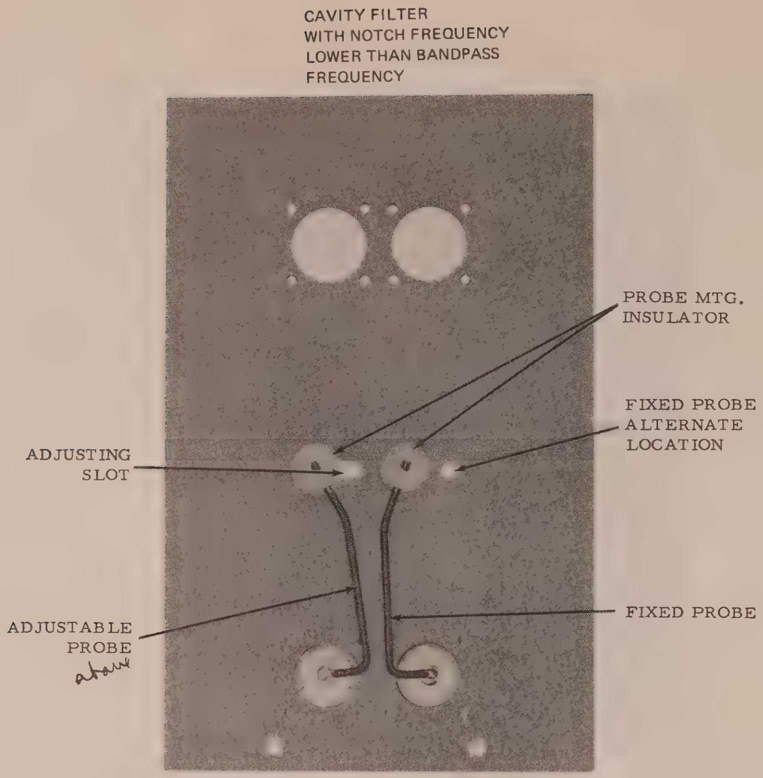

CAVITY FILTER WITH NOTCH FREQUENCY HIGHER THAN BANDPASS FREQUENCY
FIXED LOOP
ADJUSTABLE LOOP
below
FIXED LOOP ALTERNATE LOCATION
ADJUSTING SLOT

Figure 3. FAEPS–2624–A
TLE6432A (Loops Coded YEL, BLU)
TLE6434A (Loops Coded GRAY, VIOLET)
Notch Coupling Loop Kit
(Interior View)



FAEPS–2625–A

Figure 4.
TLE6433A Notch Coupling Probe Kit
(Interior View)

in the filter cavity. The loops may be properly oriented by referring to Figure 5. Select the desired insertion loss configuration.

(1) Place the left-hand coupling loop in the left coupling loop opening in the cavity. Position the loop with the dots in the proper position as shown in Figure 5. Fasten in place with the mounting hardware supplied.

(2) Install the right-hand coupling loop, properly oriented, in the right-hand opening of the cavity. Secure with the mounting hardware provided.

NOTE

When changing from 0.5 dB to either 1.0 or 2.5 dB settings, CL1 must be removed from the cavity and exchanged with the other coupling loop, rotating both loops to the correct position as shown in Figure 5. In the 2.5 dB insertion loss position, use the auxiliary set of loops supplied with the cavity.

b. Notch Coupling Loops (Kit TLE6432A)

Models T1501AH, T1502A, T1503A and T1504A employ notch coupling loops. These have a fixed insertion loss of 0.5 - 0.7 dB when correctly installed. Refer to Figure 3. The notch coupling loops can be installed without removing the cavity bottom cover assembly.

(1) Place the adjustable loop in the right-hand position so that the extruded and tapped hole in the loop lines up with the adjusting slot in the cavity body assembly.

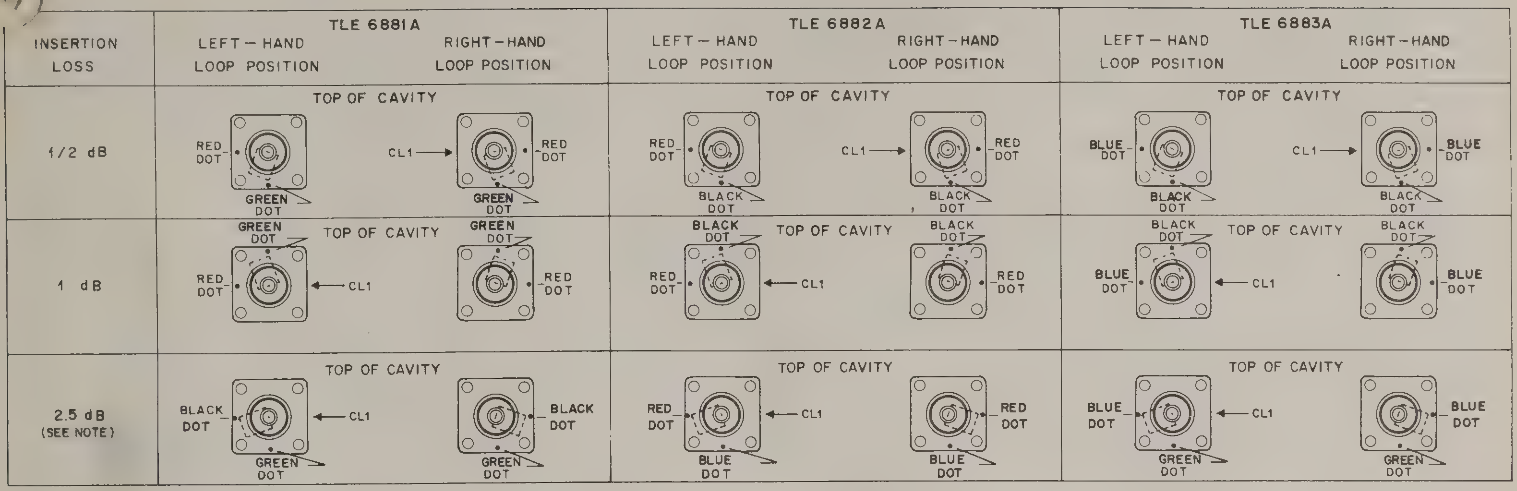
(2) Secure the adjustable loop to the cavity body with a knurled machine screw provided, using a lockwasher and plastic washer under the screw head.

(3) Fasten the UHF connector to the cavity body with the self-tapping hardware provided.

(4) Determine the correct location for the fixed loop.

If the required separation between the filter pass and reject frequencies is greater than 2 and less than 5 MHz, use the fixed location closest to the adjusting slot.

If the required separation is greater than 5 MHz and less than 8 MHz, use the fixed location furthest from the adjusting slot, and use loop kit Model TLE6434A.



NOTES :
1. USE AUXILIARY LOOPS IN 2.5 dB APPLICATION

CEPS-32099-0

Figure 5.
Passband Coupling Loop Positions
(Exterior View)

(5) Place the fixed loop in the left-hand position so that the extruded and tapped hole in the loop lines up with the desired fixed hold location in the cavity body.

(6) Secure the fixed loop to the cavity body with a knurled machine screw provided, using a lockwasher and plastic washer under the screw head.

(7) Fasten the UHF connector to the cavity body with the self-tapping hardware provided.

c. Notch Coupling Probes (Kit TLE6433A)

Models T1501AL, T1502A, T1503A and T1504A employ notch coupling probes. These have a fixed insertion loss of 0.5-0.7 dB when correctly installed. Refer to Figure 4.

(1) Remove the cavity bottom cover assembly.

(2) Place a mounting insulator on the adjustable probe.

(3) Insert the adjustable probe and the mounting insulator into the right-hand loop position so that the copper threaded stem of the mounting insulator extends through the adjusting slot in the cavity body.

(4) Secure the adjustable probe to the cavity body with a knurled nut provided, using a lockwasher and plastic washer under the nut.

(5) Fasten the UHF connector to the cavity body with the self-tapping hardware provided.

(6) Determine the correct location for the fixed probe.

If the required separation between filter pass and reject frequencies is greater than 2 MHz and less than or equal to 5 MHz, use the fixed location closest to the adjusting slot.

If the required separation is greater than 5 MHz and less than 8 MHz, use the fixed location furthest from the adjusting slot.

(7) Place the fixed probe in the left-hand position so that the mounting insulator stud extends through the desired fixed hole location in the cavity body.

(8) Secure the fixed probe to the cavity body with a knurled nut provided, using a lockwasher and plastic washer under the nut.

(9) Fasten the UHF connector to the cavity body with the self-tapping hardware provided.

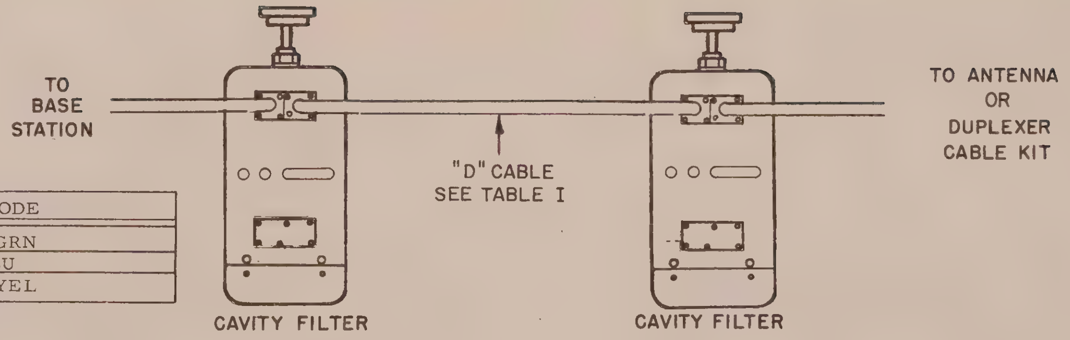
(10) Replace the cavity bottom cover assembly.

MODEL T1505A

TABLE I

MODELS T1505A & T1506A

FREQ. RANGE	CABLE KIT	"D" CODE
406-430 MHz	TKN6544A	BLK-GRN
430-470 MHz	TKN6545A	BLU
470-512 MHz	TKN6546A	BRN-YEL



MODEL T1506A

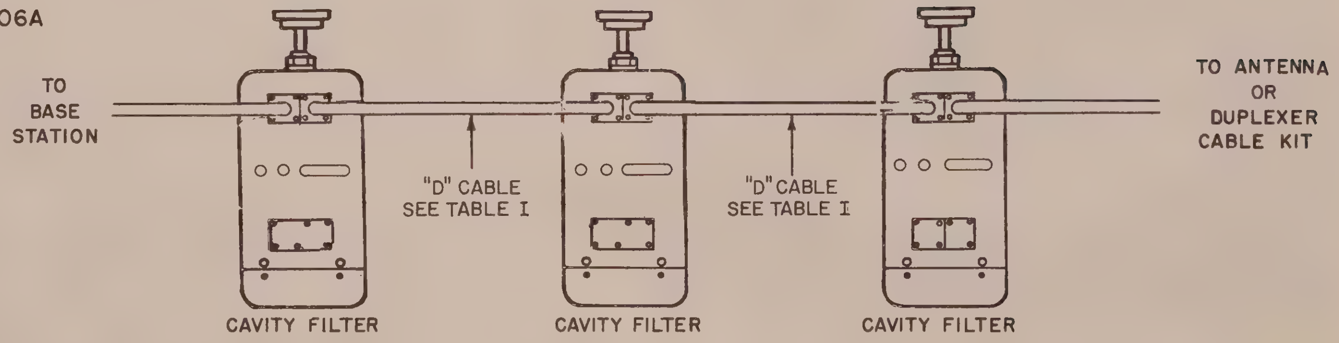


TABLE II

MODEL T1507A

FREQ. RANGE	CABLE KIT	"D" CODE	"B" CODE
406-430 MHz	TKN6549A	BLK-GRN	ORG
430-470 MHz	TKN6550A	BLU	GRN
470-512 MHz	TKN6551A	BRN-YEL	BLK-BLU

MODEL T1507A

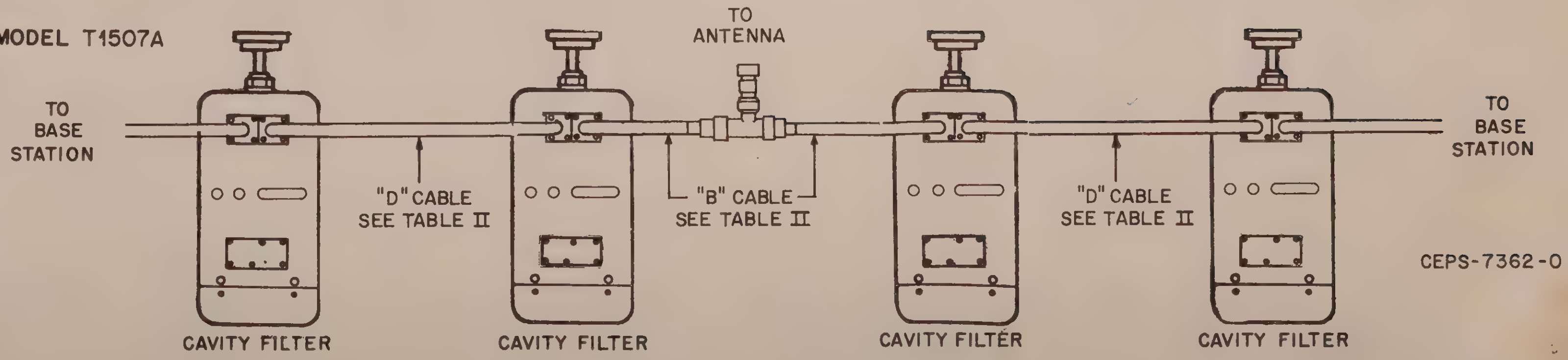
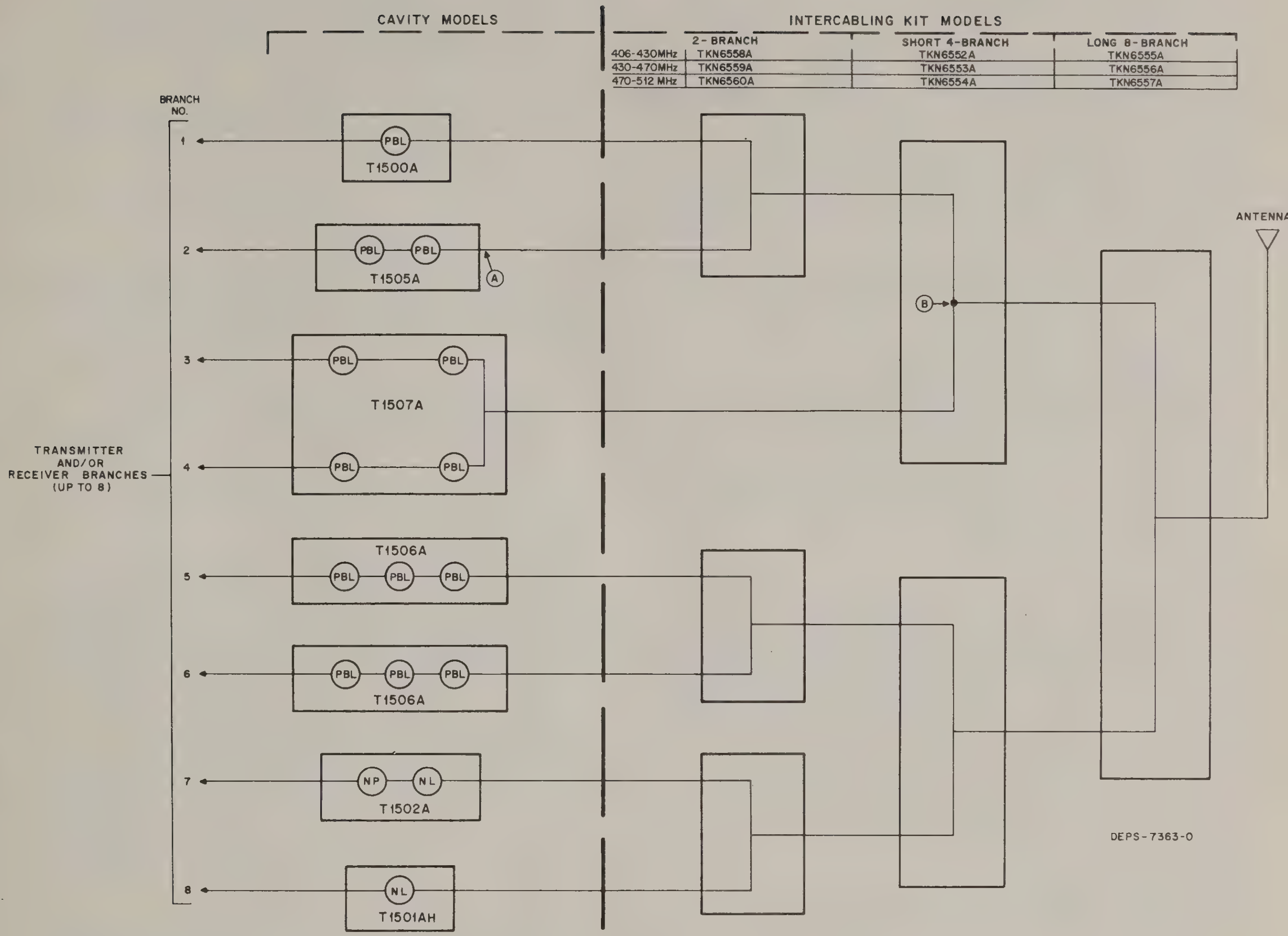


Figure 6.
Passband Filter and Duplexer Cabling Details



	2-BRANCH	SHORT 4-BRANCH	LONG 8-BRANCH
406-430MHz	TKN6558A	TKN6552A	TKN6555A
430-470MHz	TKN6559A	TKN6553A	TKN6556A
470-512 MHz	TKN6560A	TKN6554A	TKN6557A

Figure 7.
Intercabling Diagram for Multiplexing Applications

NOTES:

1. PBL = PASSBAND LOOP; NP = NOTCH PROBE; NL = NOTCH LOOP
2. IF A T1502A CAVITY FILTER IS USED, AS IN BRANCH NO. 7, THE NOTCH COUPLING LOOP MUST BE CONNECTED TO THE INTERCABLING KIT.
3. IF A T1501AL CAVITY FILTER IS USED INSTEAD OF A T1501AH CAVITY FILTER IN BRANCH NO. 8, ONE OF THE FOLLOWING CABLE KITS IS REQUIRED.

406-430 MHz	TKN6538A
430-470 MHz	TKN6539A
470-512 MHz	TKN6540A

4. IF AN ODD NUMBER OF BRANCHES ARE REQUIRED (FOR EXAMPLE, IF BRANCH NO. 1 IS NOT REQUIRED), THEN POINT Ⓐ ON BRANCH NO. 2 MUST BE CONNECTED TO THE 4-BRANCH CABLE KIT (POINT Ⓑ) WITH ONE OF THE FOLLOWING CABLE ASSEMBLIES:

406-430 MHz	1-84459A04
430-470 MHz	1-84459A06
470-512 MHz	1-84459A16

EPS-7367-O

5. MULTIPLEXING

a. Applications

Motorola offers three duplexer packages, Models T1503A, T1504A and T1507A for use with repeaters. For systems requiring more than two inputs to a common antenna, T1500A Series Motorola Cavity Filters may be converted to a multiplexer configuration with three optional intercabling kits.

Figure 6 illustrates two models of passband filters and a passband duplexer and Figure 7 shows a possible multiplexing application involving eight inputs (branches).

Figure 7 constitutes only one of several thousand possible networks, each one highly dependent upon the base station equipment and frequencies used. Consult your Motorola Area Systems Engineering Department for assistance with your particular requirements.

b. Isolation

The Passband Filter Isolation Curves in Figure 16 are included for your reference. These curves show the typical isolations provided by each filter model, when used in a duplexer or multiplexer configuration.

Figure 14 details the kits and insertion loss settings available from the factory. Isolation in Figure 16 is measured between points #1 and #2 as shown in Figure 14.

6. RECOMMENDED TUNING PROCEDURES

All filters and duplexers are tuned to the customer-specified frequencies prior to shipment from the factory. If system performance indicates the duplexer is detuned, one of the following procedures may be used. Do not attempt to retune unless the following procedures have been read, and do not attempt to "touch-up" the tuning unless the complete tuning procedure is going to be followed.

a. Method 1 (Models T1503A, AF and T1504A, AF)

(1) Recommended Test Equipment

(a) "Motorola" Model S1341A or S1342A Signal Generator.

(b) Tunable receiver or two "Motorola" receivers, one tuned to each of the frequencies to be duplexed.

(2) Tuning Procedure (refer to Figure 8)

(a) With the signal generator and the receiver tuned to the pass frequency, adjust the center conductor of the cavity for minimum signal loss through the cavity.

(b) With the signal generator and the receiver tuned to the reject frequency, adjust the movable loop for maximum signal loss through the cavity. To do this, loosen the knurled screw slightly. Move the screw until minimum signal is received and then re-tighten the screw. The screw may move slightly when it is tightened, so it is advisable to have the screw tight enough so that the screw can barely be moved when adjusting.

(c) Steps (1) and (2) should be repeated for every cavity in the duplexer.

(d) Connect the duplexer to the transmitter, receiver and antenna with 50-ohm coaxial cable (not supplied). Adjust the transmitter final amplifier for rated power into the duplexer. After all tuning is complete, the tuning knobs may be removed to prevent accidental detuning or tampering by unauthorized personnel.

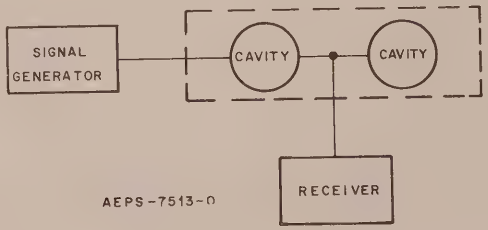


Figure 8.
Method 1 Test Set-Up

b. Method 2 (Models T1503A, AF and T1504A, AF)

(1) Recommended Test Equipment

(a) Mixer circuit constructed as shown in Figure 9.

(b) "Motorola" Model S1341A, S1342A or R1201A Signal Generator.

(c) IF output from an S1318A or R1201A Signal Generator equal to the duplex frequency separation or a "Motorola" S1056A/B Portable Test Set with a crystal frequency equal to the duplex frequency separation.

(d) "Motorola Wattmeter with appropriate elements.

(e) "Motorola" T1013A RF Load Resistor.

(f) Isolated Tee connector (construct this by removing the Tee port of a UHF Tee connector). This provides 30 to 40 dB of isolation between the shunt path and the direct path through the Tee to protect the receiver when the transmitter is keyed.

(g) Transmitter and receiver from the station to be duplexed

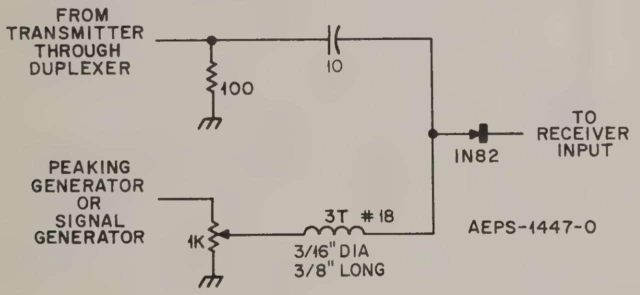

FROM TRANSMITTER THROUGH DUPLEXER
10
100
TO RECEIVER INPUT
IN82
PEAKING GENERATOR OR SIGNAL GENERATOR
3T #18
AEPS-1447-0
1K
3/16" DIA
3/8" LONG

Figure 9.
Mixer Circuit

(2) Operation of the Mixer Circuit

Alignment of the duplexers can be simplified by using the mixer circuit shown in Figure 9. The mixer receives inputs from the transmitter and a low frequency source. The outputs from the mixer are frequencies above and below the transmitter frequencies at separations equal to the output of the low frequency generator.

The receiver will respond to one of the mixer products and thus can be used indirectly to detect the transmitter frequency.

(3) Tuning Procedure for Transmitter Branch of the Duplexer

(a) Connect the equipment as shown in Figure 10.

(b) Adjust the center conductors of the transmitter cavities for maximum wattmeter readings.

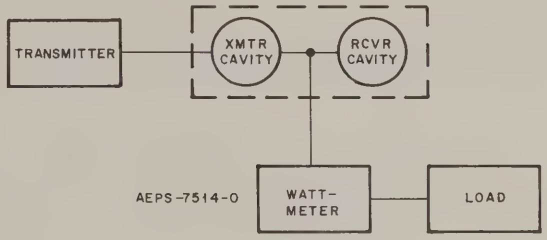


Figure 10.
Method 2 Transmitter Branch Pass Test Set-Up

(c) Connect the equipment as shown in Figure 11.

(d) Tune the signal generator to the exact receiver frequency. Adjust the movable loop for maximum loss through the cavity. Refer to Method 1 for adjustment aids.

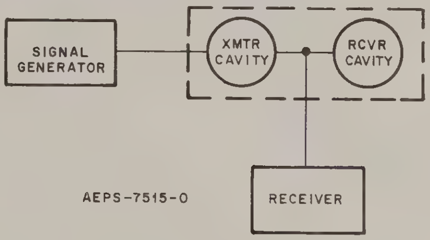


Figure 11.
Method 2 Transmitter Branch Reject Test Set-Up

(4) Tuning Procedure for Receiver Branch of the Duplexer

(a) Connect the equipment as shown in Figure 12.

(b) Tune the signal generator to the exact receiver frequency. Adjust the center conductors of the receiver cavities for minimum loss through the cavities (maximum receiver signal).

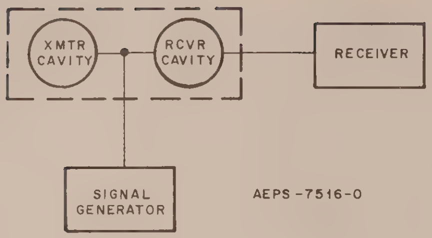


Figure 12.
Method 2 Receiver Branch Pass Test Set-Up

(c) Connect the equipment as shown in Figure 13.

(d) Set the local oscillator source to the exact duplex frequency separation. Adjust the movable loop for maximum loss through the cavity (minimum signal to the receiver). Refer to Method 1 for adjustment aids.

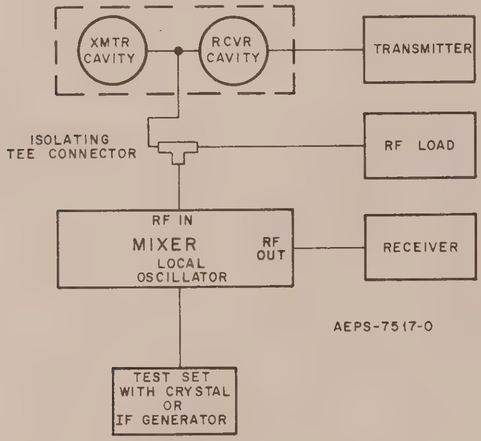


Figure 13.
Method 2 Receiver Branch Reject Test Set-Up

(5) Connect the duplexer to the transmitter, receiver and antenna with 50-ohm coaxial cable (not supplied). Adjust the transmitter final amplifier for rated power into the duplexer. After all tuning is complete, the tuning knobs may be removed to prevent accidental detuning or tampering by unauthorized personnel.

c. Tuning Procedures for all other Models

(1) Models T1501AH and T1501AL may be tuned by Method 1 or Method 2 using only the single cavity instead of a duplexer. Depending on the method used, omit either step (d) -- Method 1 -- or step (5) -- Method 2.

(2) Models T1500A, T1505A, T1506A and T1507A have only passband loops but no notch loops and probes. They may be tuned by using only steps (3) (a) and (b), and steps (4) (a) and (b) of Method 2.

(3) Model T1502A may be tuned by tuning each center conductor for minimum loss through the cavities. This should be adequate unless the reject frequencies also require retuning. If this is the case, use Method 1 with a tunable receiver but omit step (d).

7. ALTERNATE TUNING PROCEDURE

If the preceding methods can not be used, all models may be tuned using the following methods.

a. Cavity Tuning in Receiver Applications

Tuning cavities for receiver branch circuits entails individual tuning of each cavity in a multiple-cavity setup followed by repeaking of the group of cavities connected in their normal configuration. Individual tuning of each cavity requires disconnection of the cavity from its associated cabling, and connection to a signal generator and receiver. After each cavity is tuned, the intercabling must be reconnected and the final adjustment is made to the combined set of cavity resonators, using the same test equipment.

(1) Passband Tuning-Receiver Applications

(a) Connect the test set cable to the receiver meter socket. Set the test set to read meter position 4.

(b) Connect the signal generator to the receiver input. Set the signal generator "on-frequency" by adjusting the signal generator frequency for zero reading on meter position 4 (discriminator).

(c) Disconnect the signal generator from the receiver input and connect it to the input of the cavity to be tuned.

(d) Connect the output of the cavity to the receiver input.

(e) Set the test set to read meter position 1.

(f) Adjust the signal generator output to produce a usable reading on test set meter position 1. Keep the level below saturation.

(g) Tune cavity for maximum meter reading by adjusting the tuning knob on top of the cavity. One turn of the tuning knob will change the resonance point approximately 1.8 MHz. Keep the meter reading below the point of saturation by reducing generator output as necessary.

(h) After the cavity is tuned for a peak reading, disconnect the test cables and reconnect the proper operating cables.

(2) Rejection Notch Tuning - Receiver Applications

(a) Connect the dummy load to the antenna receptacle.

(b) Loosely couple the signal generator to the receiver by proximity radiation to the front end, or with an isolating tee connector inserted in the antenna line.

CAUTION

This isolation must be used to protect the signal source from destruction by transmitter rf power.

(c) With the transmitter off, measure the quieting sensitivity of the receiver.

(d) With the transmitter keyed, repeat the quieting sensitivity measurement.

(e) Adjust the loops or probes for maximum quieting sensitivity as measured with the transmitter keyed. Turn transmitter off when making adjustments. As a general guide, the spacing of the loops or probes will be directly proportional to the spacing of the transmit and receive frequencies; i.e., if the transmit and receive frequencies are widely separated, the loops or probes will be widely spaced near the end of their mechanical limit; if the frequencies are close together, the loops or probes will be relatively close together.

(f) After the loops or probes are properly adjusted, lock them in place by tightening the knurled knob.

(g) Adjust the tuning shaft a maximum of 10-15° to peak up the notch.

b. Cavity Tuning in Transmitter Applications

Tuning transmitter branch cavity circuits entails individual tuning of each cavity in a multiple-cavity setup followed by repeaking of the group of cavities connected in their normal configuration. Individual cavity tuning requires disconnection of the cavity from its associated cabling, and connection to the transmitter and wattmeter for passband tuning, or to the signal generator and receiver for notch tuning. After each cavity is tuned, the intercabling must be reconnected and final adjustment must be made to the combined set of cavity resonators, using the same test equipment.

(1) Passband Tuning - Transmitter Applications

(a) Connect the transmitter to the wattmeter. Connect the wattmeter to the rf load resistor.

(b) Key the transmitter and adjust the transmitter tuning according to the alignment procedure given in the appropriate instruction manual.

(c) After the transmitter is correctly tuned, unkey the transmitter and disconnect the wattmeter from the transmitter.

(d) Connect the transmitter to the cavity input. Connect the wattmeter to the cavity output. Leave the rf load resistor connected to the wattmeter.

(e) If the transmitter is equipped with a TUNE-OPERATE switch, HIGH-LOW switch, or other means of reducing power, set the transmitter to this low-power position.

(f) Key the transmitter, and adjust the tuning knob on the top of the cavity for maximum forward power. One turn of the tuning knob will change the resonance point approximately 1.8 MHz. After the cavity tuning is peaked, switch the transmitter to its full power position and repeak the cavity, if necessary.

(g) Repeat the tuning procedure for each cavity in multiple-cavity setups.

(h) After each cavity has been tuned individually, connect all cavities in a multiple-cavity setup for normal use and check the tuning of the entire group.

(i) Remove the rf load resistor and connect the antenna. Adjust the transmitter final amplifier slightly for rated power output into the cavity filter.

(2) Rejection Notch Tuning - Transmitter Applications

Cavities connected in the transmitter branch lines must be tuned individually. Presuming that the cavities are to be tuned for rejection on the receiver frequency, the associated receiver may be employed in the tuning process.

(a) Disconnect the cavity to be tuned from its normal cabling.

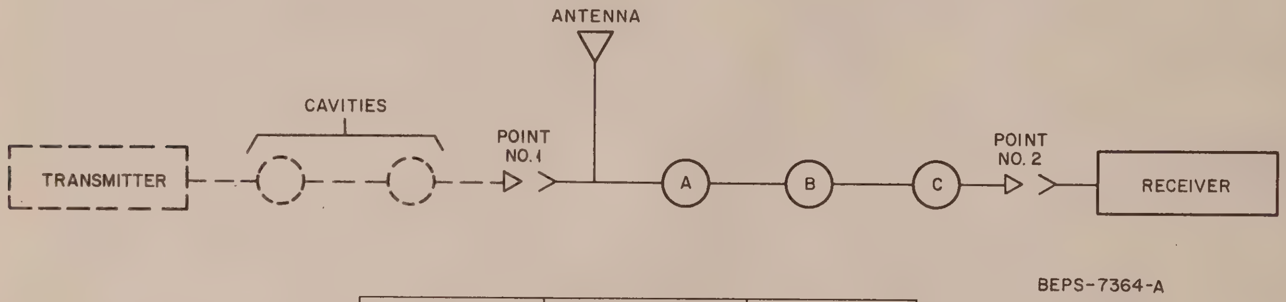
(b) Connect the signal generator to the cavity input; connect the cavity output to the receiver input.

(c) With the signal generator set on the desired frequency, adjust the cavity loop or probe for maximum attenuation of the injected signal. To adjust a loop or probe, loosen the knurled knob on the side of the cavity and move the knob in the slot in the housing.

(d) When the loop or probe is properly positioned for maximum attenuation of the test signal, lock it in place.

(e) Adjust the tuning shaft a maximum of 10-15° to peak up the notch.

(f) In multiple-cavity installations, repeat the tuning procedure for each cavity in the chain.



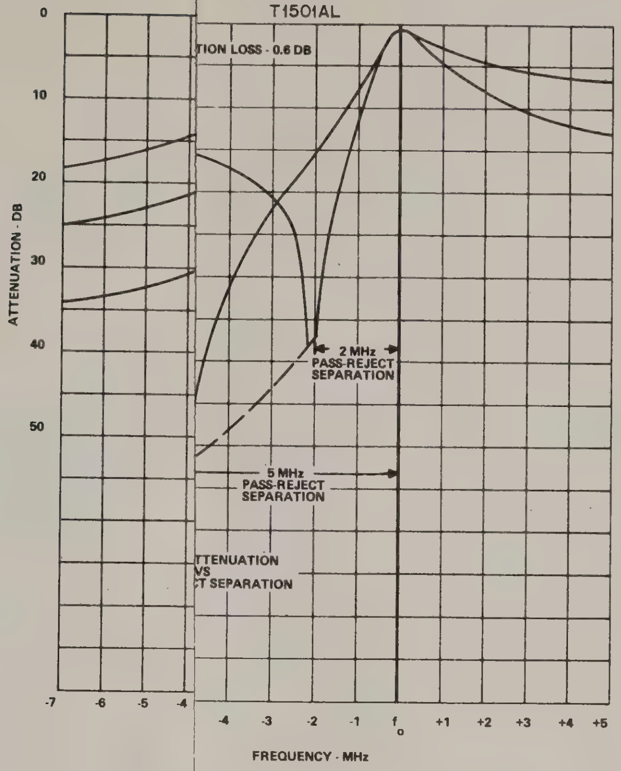
MODEL	COUPLING LOOPS			TOTAL INSERTION LOSS
	A	B	C	
T1500A	0.5			0.5
	1.0			1.0
	2.5*			2.5
T1505A	0.5	0.5		1.0
	1.0	1.0		2.0
	2.5*	1.0		3.5
T1506A	0.5	0.5	0.5	1.5
	1.0	1.0	1.0	3.0
	2.5*	1.0	1.0	4.5
T1507A	SAME VALUES AS T1505A FOR EACH LEG			

NOTE: ALL VALUES ARE IN DB'S
* USE AUXILIARY LOOPS IN THIS APPLICATION.

Figure 14.
Isolation Measurement Diagram

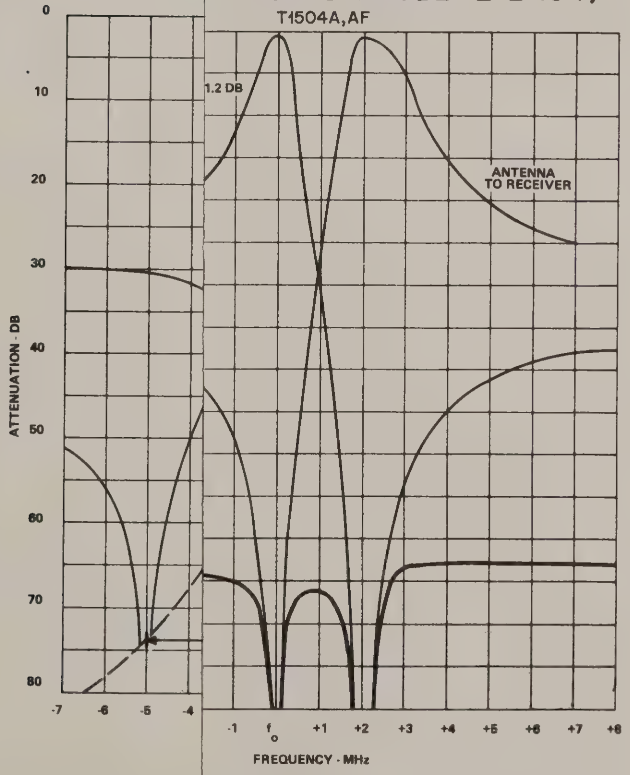
CH PROBE FILTER

T1501AL



-REJECT DUPLEXER
LOOP 8 PROBE-2 EACH)

T1504A,AF



EEPS-7365-0

the receiver frequency, the associated receiver may be employed in the tuning process.

(a) Disconnect the cavity to be tuned from its normal cabling.

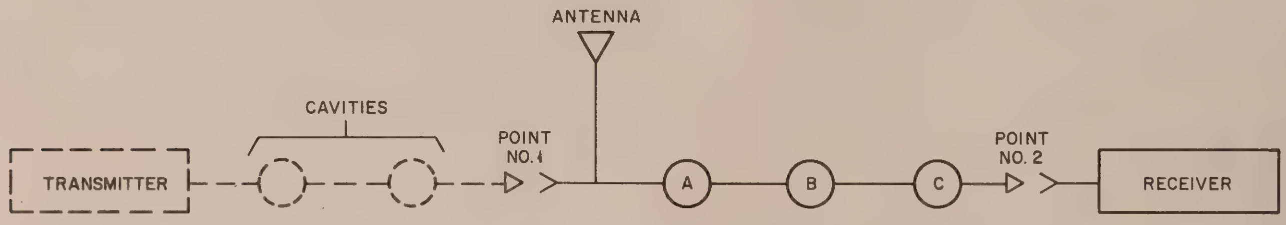
(b) Connect the signal generator to the cavity input; connect the cavity output to the receiver input.

(c) With the signal generator set on the desired frequency, adjust the cavity loop or probe for maximum attenuation of the injected signal. To adjust a loop or probe, loosen the knurled knob on the side of the cavity and move the knob in the slot in the housing.

(d) When the loop or probe is properly positioned for maximum attenuation of the test signal, lock it in place.

(e) Adjust the tuning shaft a maximum of 10-15° to peak up the notch.

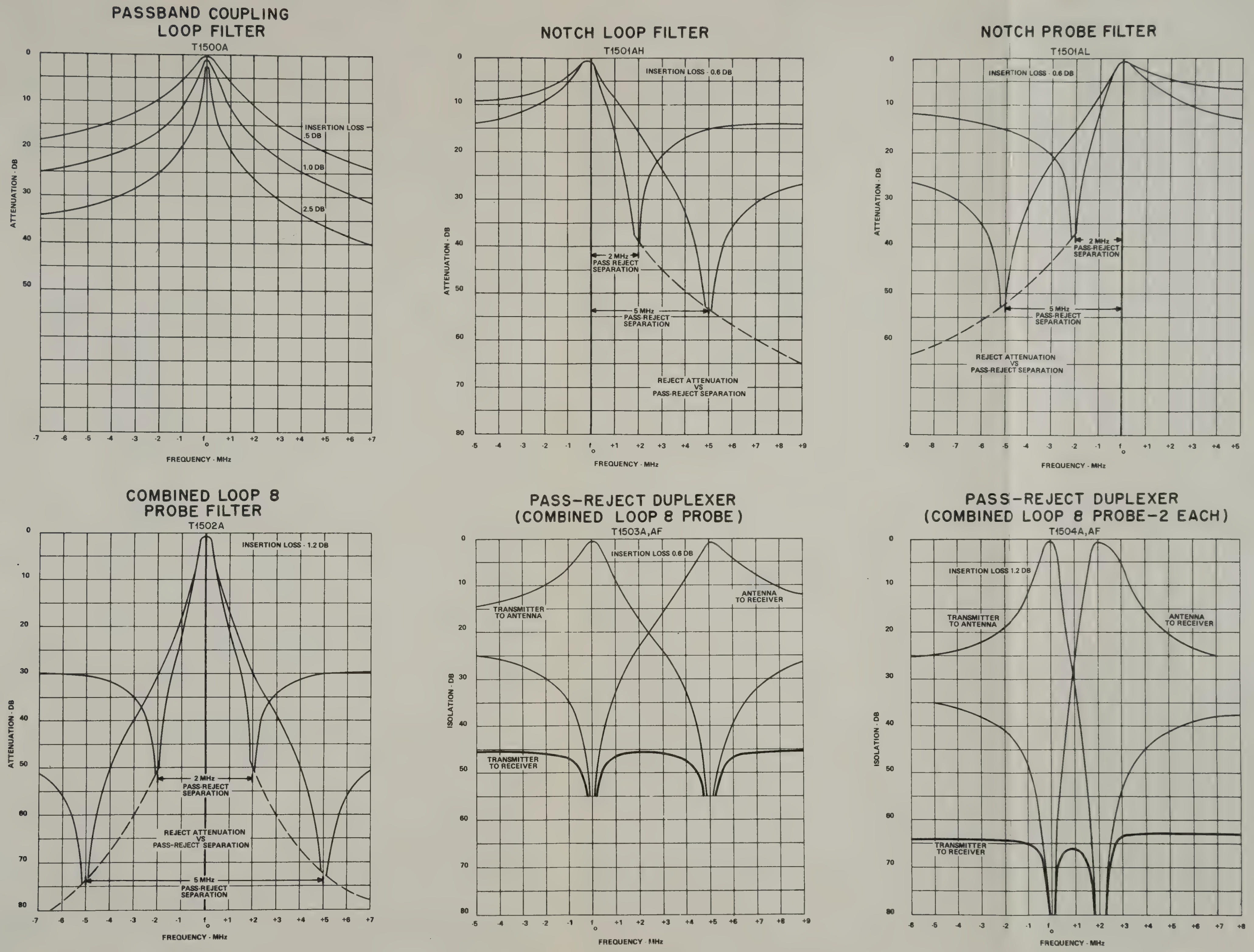
(f) In multiple-cavity installations, repeat the tuning procedure for each cavity in the chain.



MODEL	COUPLING LOOPS			TOTAL INSERTION LOSS
	A	B	C	
T1500A	0.5			0.5
	1.0			1.0
	2.5*			2.5
T1505A	0.5	0.5		1.0
	1.0	1.0		2.0
	2.5*	1.0		3.5
T1506A	0.5	0.5	0.5	1.5
	1.0	1.0	1.0	3.0
	2.5*	1.0	1.0	4.5
T1507A	SAME VALUES AS T1505A FOR EACH LEG			

NOTE: ALL VALUES ARE IN DB'S
* USE AUXILIARY LOOPS IN THIS APPLICATION.

Figure 14.
Isolation Measurement Diagram



PASSBAND COUPLING LOOP FILTER

T1500A

NOTCH LOOP FILTER

T1501AH

NOTCH PROBE FILTER

T1501AL

COMBINED LOOP 8 PROBE FILTER

T1502A

PASS-REJECT DUPLEXER (COMBINED LOOP 8 PROBE)

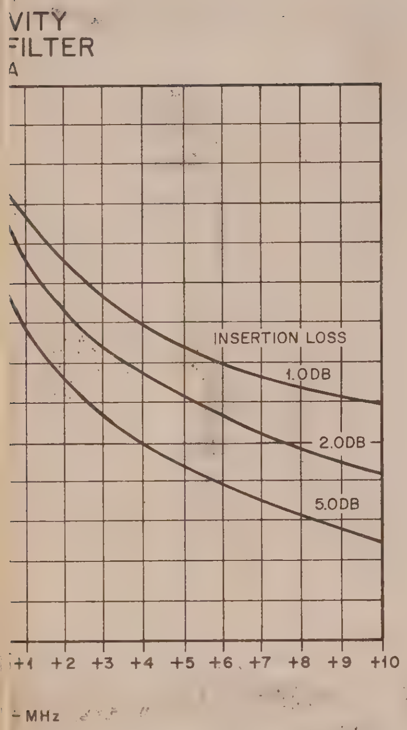
T1503A,AF

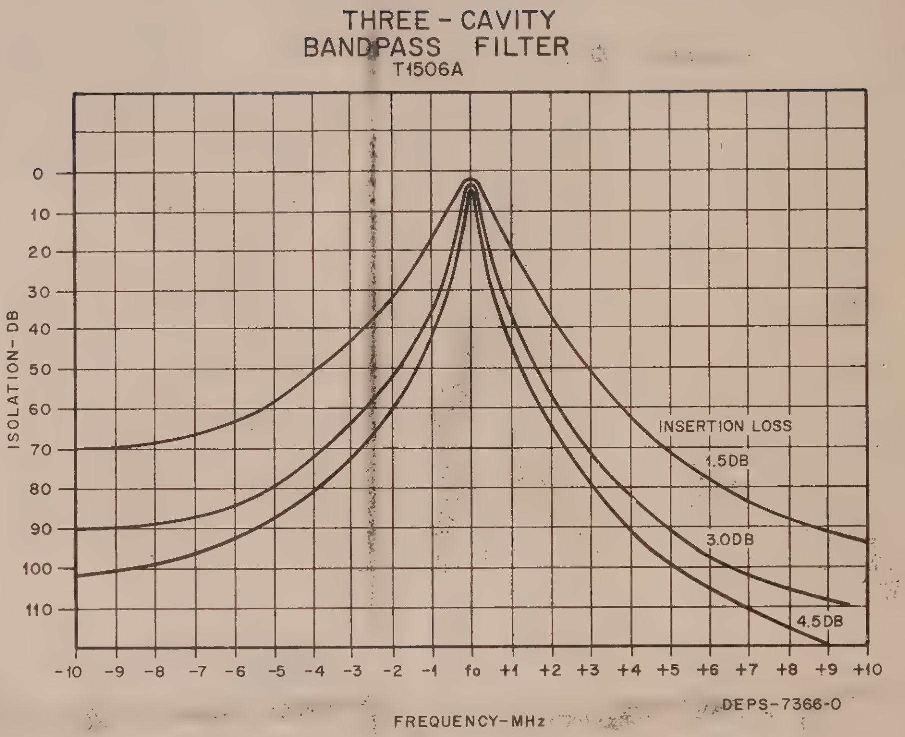
PASS-REJECT DUPLEXER (COMBINED LOOP 8 PROBE-2 EACH)

T1504A,AF

EEPS-7365-0

Figure 15.
Filter and Duplexer Selectivity Curves
Typical for 430-470 MHz Range



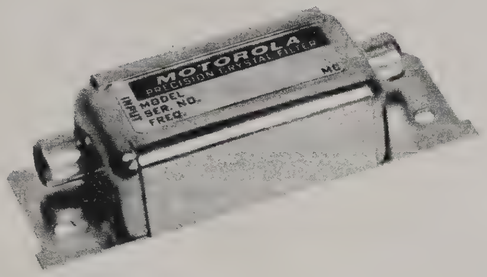


6.
rves
exer T1505A, T1506A
30-470 MHz Range

MOTOROLA
PRECISION CRYSTAL FILTERS

IMPORTANT

These filters are frequency sensitive and must be ordered to a receiver's exact frequency. In addition, the filters are available only within the range of frequencies specified -- filters are not available for stations that operate outside these limits.



MODEL CHART

MODEL	FREQUENCY
TLB6310A	25-50 MHz
TLD6340A	136-174 MHz

1. APPLICATION

The filters listed in the Model Chart are used to improve reception in areas where strong off-frequency interfering signals are present. They are available as factory installed kits on new base station receivers or for field installation in existing base station receivers.

For installation information refer to the instructions packed with the installation kit.

APPLICATION TABLE

Type of Station	Filter & Installation Kit		Installation Kit Only
	25-50 MHz	136-174 MHz	
"Consolette" Base Station	TLN1040A	TLN1016A	TLN6714A (Section 68P81104A87)
Desk Top Base Station	TLN1041A	TLN1017A	TLN6715A (Section 68P81104A88)
"Compa-Station"® Base Station Indoor, Outdoor and Repeater Stations	TLN1042A	TLN1018A	TLN6716A (Section 68P81104A89)
Transistorized Indoor and Outdoor Stations; Transistorized "Compa-Station"® Base Radios and Solid-State Base Stations	TLN1077A	TLN1076A	TLN8224A (Section 68P81110A28)
"Micor"® Base Stations and Repeaters	TLN1539A	TLN1538A	TLN5120A (Section 68P81104E36)

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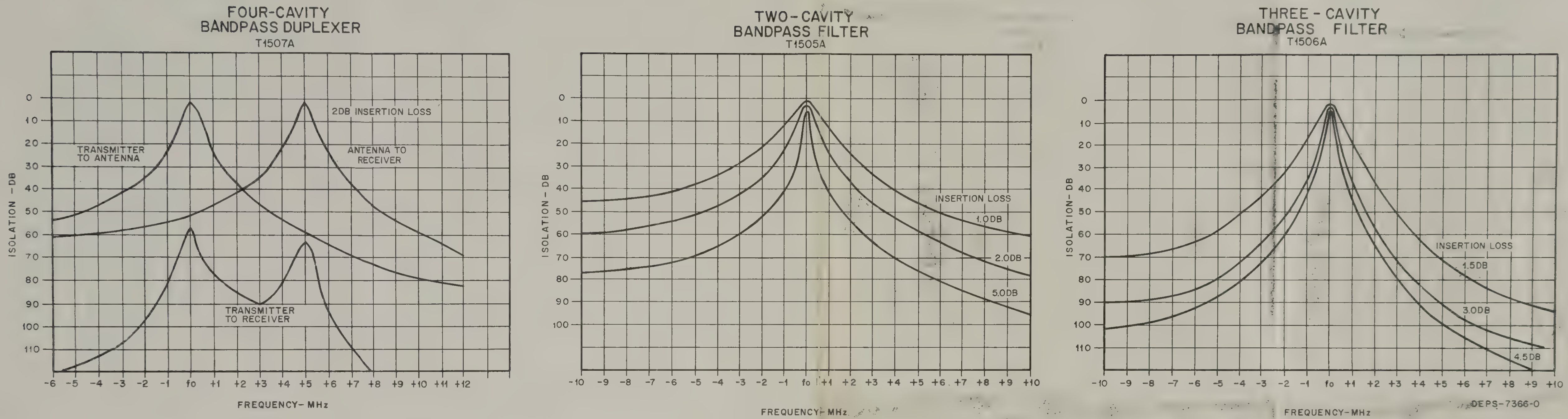
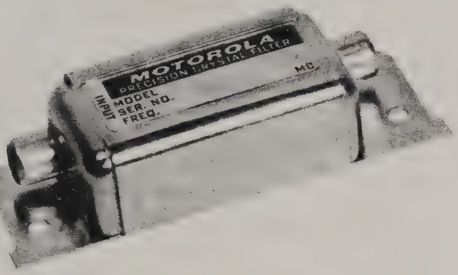


Figure 16.
Isolation Curves
Bandpass Filters and Duplexer T1505A, T1506A
& T1507A Typical for 430-470 MHz Range

MOTOROLA
PRECISION CRYSTAL FILTERS

IMPORTANT

These filters are frequency sensitive and must be ordered to a receiver's exact frequency. In addition, the filters are available only within the range of frequencies specified -- filters are not available for stations that operate outside these limits.



MODEL CHART

MODEL	FREQUENCY
TLB6310A	25-50 MHz
TLD6340A	136-174 MHz

1. APPLICATION

The filters listed in the Model Chart are used to improve reception in areas where strong off-frequency interfering signals are present. They are available as factory installed kits on new base station receivers or for field installation in existing base station receivers.

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APPLICATION TABLE

Type of Station	Filter & Installation Kit 25-50 MHz	Filter & Installation Kit 136-174 MHz	Installation Kit Only
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Desk Top Base Station	TLN1041A	TLN1017A	TLN6715A (Section 68P81104A88)
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GUARANTEED PERFORMANCE SPECIFICATIONS

BANDWIDTH	±7 kHz minimum at 1 dB	
MAXIMUM INPUT SIGNAL LEVEL	1 volt across 50 ohms (20 mW) -17 dBW	
IMPEDANCE, INPUT AND OUTPUT	50 ohms	
DIMENSIONS	3" x 1" x 11/16" overall	
FREQUENCY RANGE	25-50 MHz	136-174 MHz
INSERTION LOSS	4 dB max.	6 dB max.
DESENSITIZATION IMPROVEMENT ADJACENT CHANNEL: ALTERNATE CHANNEL & GREATER:	 11 dB min. 20 dB min.	 13 dB min. 20 dB min.
INTERMODULATION IMPROVEMENT ADJACENT/ALTERNATE CHANNELS ALL OTHERS:	 15 dB min. 20 dB min.	 17 dB min. 20 dB min.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

NOTE

THE FILTERS ARE SEALED UNITS AND SHOULD NOT BE OPENED. IF OPENED, THE MANUFACTURERS WARRANTY BECOMES VOID.

2. TYPES OF INTERFERENCE

2.1 GENERAL

Base station receivers are often located in areas with strong off-frequency signals, which can seriously impair their operation when receiving on-frequency signals. Specific interference problems caused by strong off-frequency signals are described in the following paragraphs.

2.2 DESENSITIZATION

The overall selectivity of a receiver is a composite of the rf and i-f selectivities respectively, each being more selective than the one preceding it. Thus, a strong signal near the operating frequency of the receiver can pass through a number of stages before being adequately rejected by the selective elements of the receiver. Although the off-frequency signal will eventually be attenuated, its large input amplitude may overload one of the earlier stages causing the gain and sensitivity of the receiver to be reduced, thereby degrading the on-frequency performance. Normal messages become weak and "fringe area" operation is lost completely. The performance of a receiver in the presence of a strong off-frequency signal is known as its desensitizing characteristic.

2.3 INTERMODULATION (IM)

When two or more signals appear together across a non-linear element, they can mix to form new frequencies known as IM products. If one of these frequencies falls on or near the operating frequency of a receiver, and has sufficient amplitude, it may cause interference to the desired signals. This mixing can take place in the earlier stages of a receiver or in the final stages of a transmitter. These two forms of IM are discussed in the following subparagraphs.

2.3.1 Receiver Intermodulation

Receiver IM can occur when other powerful stations are located near the receiver being affected. The signals from these other stations can enter the receiver through the antenna. Normally, only desensitization would occur. However,

when these unwanted signals mix and accidentally create a signal on the receiver frequency, the unwanted product will pass through the receiver just like a normal message. The result is receiver IM interference.

2.3.2 Transmitter Intermodulation

Transmitter IM occurs when two or more powerful transmitters are close to each other. In this case, the mixing takes place within the final stages of the transmitters. It is merely brute power entering through the station antenna. This IM product frequency is retransmitted along with normal signals.

2.4 SPURIOUS RESPONSES OF THE RECEIVER

Although a receiver is designed to respond only to the desired operating frequency, it will also respond to signals on certain other frequencies if these signals are strong enough. These undesired frequency responses are known as spurious responses of the receiver. If the frequency of a nearby transmitter coincides with one of the spurious response frequencies of a receiver, the signal level from the transmitter may be strong enough to cause receiver interference.

3. ELIMINATION OF INTERFERENCE

Since desensitization, IM and spurious responses of the receiver are all caused by strong off-frequency signals, these specific interference problems can be eliminated by preventing the signals from entering the receiver. The Model TLB6310A and TLD6340A Precision Crystal Filters attenuate all off-frequency interfering signals before they enter the receiver and consequently improve the receiver desensitization, IM, and spurious response characteristics.

NOTE

Interference caused by IM products generated in a transmitter or any other nonlinear device external to a receiver cannot be rejected by this filter since the IM product is already on the desired receiver frequency when it enters the filter.

4. DESCRIPTION

The Model TLB6310A and TLD6340A Precision Crystal Filters operate in the antenna lead of the receiver and are tuned to one specific operating frequency; consequently, these filters must be ordered for a specific channel frequency. Since a filter passes only the desired channel frequency, and rejects all others (see selectivity curves), it is important that the system in which the filter is used is accurately netted. The received signals must be within ±.0005% (136-174 MHz) or ±.002% (25-50 MHz) of the assigned channel frequency to insure that they are centered in the passband of the filter. Any off-frequency interfering signals are attenuated by at least the amounts shown on the performance specifications before entering the receiver input.

The TLB6310A and TLD6340A Precision Crystal Filters are intended for use with single-frequency non-"Extender" type receivers fed from an antenna which is not shared with any other receiver (a normal installation with a receiver and a transmitter or receiver only). For applications involving multiple-frequency receivers or a receiver which is part of a multiple-receiver system fed from a common antenna, contact your Motorola Systems Engineering representative for further details.

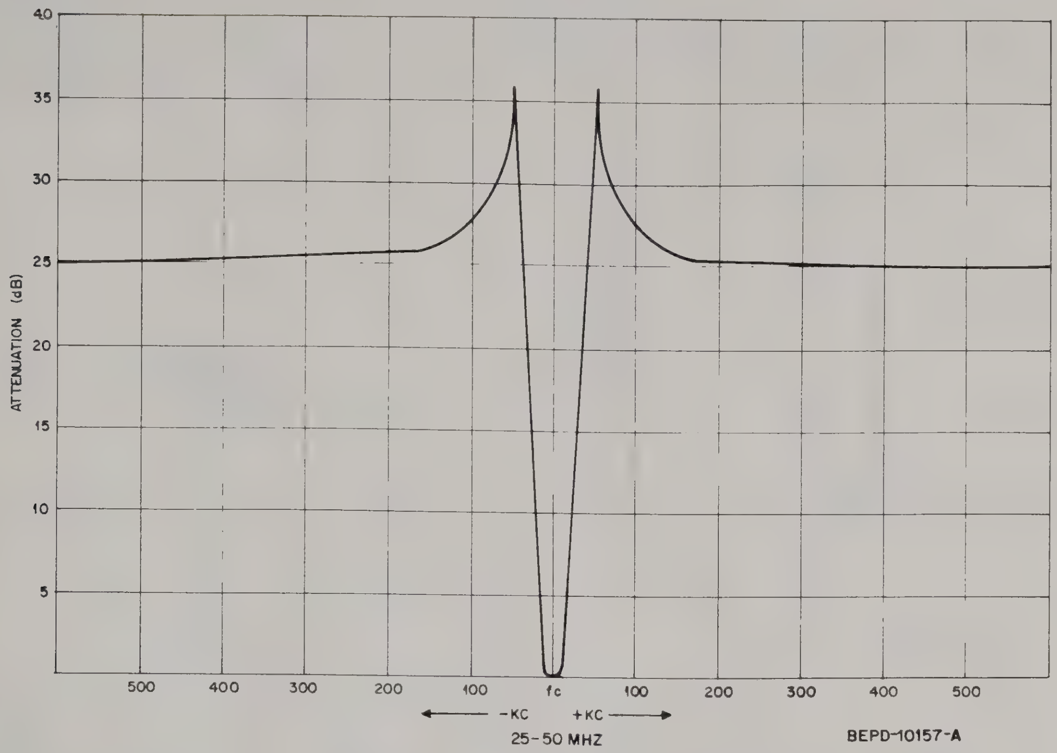
NOTE

A crystal filter must not be used on an "Extender" type receiver since the circuitry would not function properly with the filter selectivity introduced ahead of the receiver.

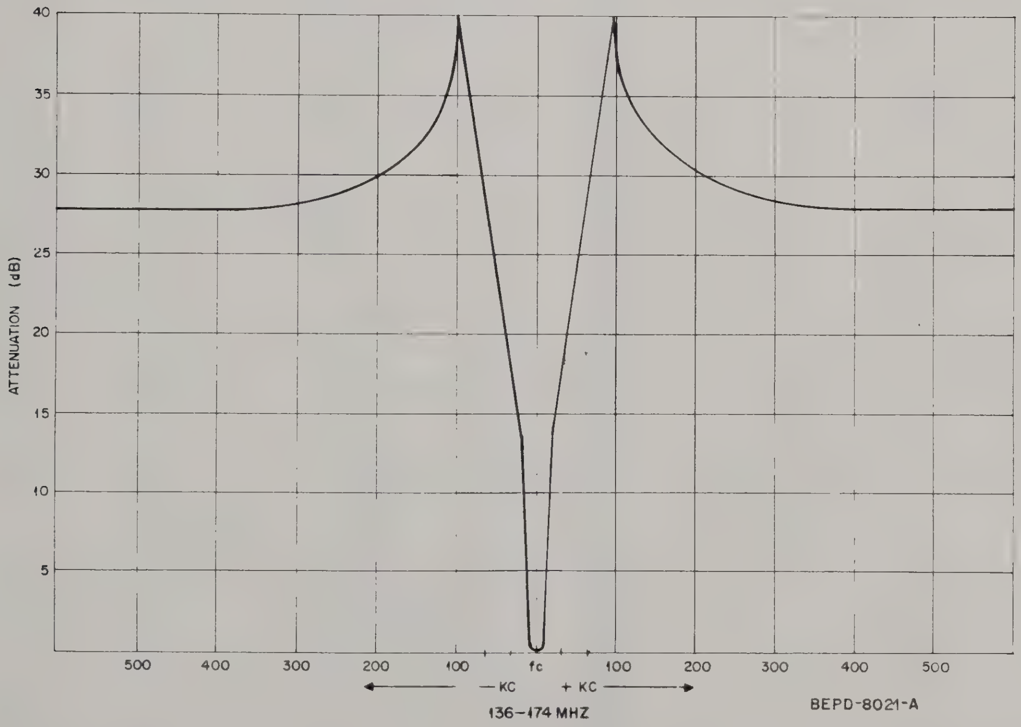
The receiver antenna lead must be connected directly to the input of the filter (via the antenna changeover relay when a transmitter shares the antenna). It must not be connected following a preamplifier, since that would limit filter performance.

CAUTION

The crystal filter is a low power device. It should never be connected in a way subjecting it to the transmitter power, since this would damage the filter.



Model TLB6310A Precision Crystal Filter Selectivity Curve



Model TLD6340A Precision Crystal Filter Selectivity Curve

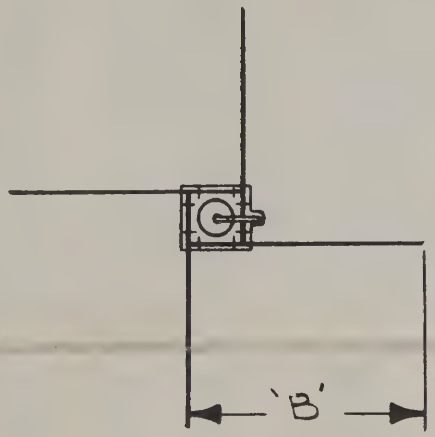
018033-001

COMPOSED BY: 12-10-69
D. PERRY

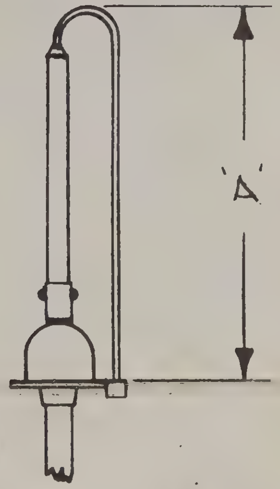
APPROVED BY:
1/27/70

TITLE:
DB 201 RADIAL AND RADIATOR LENGTHS

SHEET 1 **OF** 3



RADIAL



RADIATOR

FREQ (MC)	A	B	FREQ (MC)	A	B
30.00	90	127	32.60	82 1/2	117
.10			.70		
.20	89 1/2	126	.80	82	116 1/2
.30			.90		
.40	88 3/4	125 1/2	33.00	81 1/2	115 3/4
.50			.10		
.60	88	124 3/4	.20	81	115
.70			.30		
.80	87 1/2	124	.40	80 1/2	114 1/2
.90			.50		
31.00	87	123	.60	80	113 3/4
.10			.70		
.20	86 1/4	122 1/4	.80	79 3/4	113
.30			.90		
.40	85 3/4	121 1/2	34.00	79 1/2	112 1/2
.50			.10		
.60	85	120 3/4	.20	78 3/4	111 3/4
.70			.30		
.80	84 1/2	120	.40	78 1/4	111
.90			.50		
32.00	84	119 1/4	.60	78	110 1/2
.10			.70		
.20	83 1/2	118 1/2	.80	77 1/2	110
.30			.90		
.40	83	118	35.00	77	109 1/2
.50			.10		

REVISIONS:

DECIBEL PRODUCTS INC.
DALLAS, TEXAS

SHEET 1 OF 3

F-530

018033-001

COMPOSED BY: 12-10-69
D. PERRY

APPROVED BY:
1/27/70

TITLE:
DB 201 RADIAL AND RADIATOR LENGTHS

SHEET 2 OF 3

FREQ (MC)	89 S 90 A 1/4	B	FREQ (MC)	A	B
35.20	76 3/4	109	39.60	67 3/4	97
.30	13 1/2		.70		
.40	76 1/4	108 1/2	.80	67 1/2	96 1/2
.50			.90		
.60	75 1/2	107 3/4	40.00	67	96
.70			.10		
.80	75	107 1/4	.20	66 3/4	95 1/2
.90			.30		
36.00	74 3/4	106 1/2	.40	66 1/2	95
.10			.50		
.20	74 1/4	106	.60	66	94 1/4
.30			.70		
.40	74	105 1/2	.80	65 1/2	94
.50			.90		
.60	73 1/2	105	41.00	65	93 1/2
.70			.10		
.80	73 1/4	104 1/2	.20	64 3/4	93 1/4
.90			.30		
37.00	72 3/4	103 3/4	.40	64 1/2	92 3/4
.10			.50		
.20	72 1/4	103 1/4	.60	64 1/4	92 1/4
.30			.70		
.40	72	102 3/4	.80	63 3/4	91 3/4
.50			.90		
.60	71 1/2	102	42.00	63 1/2	91 1/2
.70			.10		
.80	71	101 1/2	.20	63 1/4	91
.90			.30		
38.00	70 3/4	101	.40	63	90 1/2
.10			.50		
.20	70 1/4	100 1/2	.60	62 1/2	90
.30			.70		
.40	70	100	.80	62 1/4	89 3/4
.50			.90		
.60	69 1/2	99 1/4	43.00	62	89 1/4
.70			.10		
.80	69	98 3/4	.20	61 3/4	88 7/8
.90			.30		
39.00	68 3/4	98 1/4	.40	61 1/2	88 1/2
.10			.50		
.20	68 1/4	98	.60	61 1/4	88
.30			.70		
.40	68	97 1/2	.80	61	87 3/4
.50			.90		

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SHEET 2 OF 3

F-530

018033-001

COMPOSED BY: 12-10-69 D. PERRY	TITLE: DB 201 RADIAL AND RADIATOR LENGTHS
APPROVED BY: 1/27/70	SHEET 3 OF 3

FREQ (MC)	A	B
44.00	60 1/2	87 1/2
.10		
.20	60 1/4	87
.30		
.40	60	86 1/2
.50		
.60	59 3/4	86
.70		
.80	59 1/2	85 1/2
.90		
45.00	59 1/4	85 1/4
.10		
.20	58 3/4	85
.30		
.40	58 1/2	84 3/4
.50		
.60	58 1/4	84 1/4
.70		
.80	58	84
.90		
46.00	57 3/4	83 1/2
.10		
.20	57 5/8	83 1/4
.30		
.40	57 1/2	82 7/8
.50		
.60	57 1/2	82 1/2
.70		
.80	57 1/4	82
.90		
47.00	57	81 3/4
.10		
.20	56 7/8	81 1/4
.30		
.40	56 3/4	81
.50		
.60	56 1/2	80 3/4
.70		
.80	56 1/4	80 3/8
.90		
48.00	56	80
.10		
.20	55 7/8	79 3/4
.30		
48.40	55 3/4	79 1/4
.50		
.60	55 1/2	79
.70		
.80	55 1/8	78 3/4
.90		
49.00	55	78 1/4
.10		
.20	54 3/4	77 7/8
.30		
.40	54 1/2	77 1/2
.50		
.60	54 1/4	77
.70		
.80	54	76 7/8
.90		
50.00	53 7/8	76 1/2

REVISIONS:	DECIBEL PRODUCTS INC. DALLAS, TEXAS	SHEET 3 OF 3

F-530

Decibel
Products,
Inc.

INSTRUCTION SHEET
DB-806/DB-809

800-900 MHz

GENERAL INFORMATION

The DB-806 and DB-809 are omni-directional antennas with gains of 6dBd and 9dBd respectively. The antennas provide a circular radiation pattern and are vertically polarized. The antennas are housed in heavy-duty fibergalss radomes to provide protection against rough handling and adverse weather conditions. Both antennas are complete with mounting clamps, a ground connection, interconnecting cable. They are typically top-mounted to provide the best omni-directional coverage.

GENERAL MOUNTING INFORMATION

The DB-806 and DB-809 are designed for mounting at the top of your tower. When the DB-806 or DB-809 antennas are mounted on the roof or tops of buildings, it is important to understand that the ground may not be very far away, i.e. not at the street level, depending upon the type and construction of the building. Because the edge of the roof does not extend out indefinitely and the building top may be constructed of a variety of materials, a change in the input impedance and pattern is possible. It is recommended that as large of a clear space and as high as possible mounting be provided for the antenna location to insure the best operation. Close to roof mounting may cause beam uptilt due to reaction with the roof edge.

GROUNDING

The antenna is grounded through the mounting clamps. In addition, a ground lug is provided so that the antenna may be directly grounded for additional protection. **It is recommended** that the installer make a hard ground connection between the antenna and the tower. A length of copper wire (36" Supplied) should be connected between the antenna ground lug and a clean, tight, and secure connection to the tower. On the tower we suggest using one of the tower bolts that has been cleaned of all paint and rust. See figure 3.

INSTALLATION PROCEDURE

1. After removing the antenna from the shipping container, inspect it to be sure all parts are on hand and that there is no physical damage.

2. Verify that the antenna you receive is the correct model and frequency that you ordered.

3. Inspect the antenna feed input connector to determine that it mates with your station transmission line.

4. Attach the mounting clamps to the mounting rings on the bottom of the antenna. **THE MOUNTING SUPPORT TUBE SHOULD NOT EXTEND ABOVE THE TOP CLAMP.** See figure 3. **Any metal** above the top clamp will distort the radiation pattern of the antenna. In some cases you may detect an increase in VSWR. The tower leg, mounting pipes, or nearby antennas will cause less than omni-directional coverage and possible dead spots.

5. Mount the antenna on the tower or support tube, making sure that the antenna is plumb and that the clamps are drawn up evenly and securely. See Figure 1.

6. A check of the antenna VSWR as measured at the antenna is recommended at this point. Note this measurement carefully and record it for future reference.

7. After checking the VSWR at the antenna, connect the station transmission line to the antenna. Make connection snug, but do not apply heavy force from pliers. Carefully cover connection with Vapor-wrap® sealant provided. Follow instruction on sealant package carefully. When connector sealant is applied correctly, the juncti[illegible] be moisture protected and should give trouble free service.

8. Properly secure the feeder c[illegible] and transmission line to the tower. See figure 2.

9. After the antenna and transmission line installation has been completed, a careful visual check should be made to insure that:

   A. All mechanical connections have been securely made;

   B. All connections have been carefully sealed to prevent moisture problems;

   C. Antenna is straight and properly grounded.

TYPICAL INSTALLATIONS

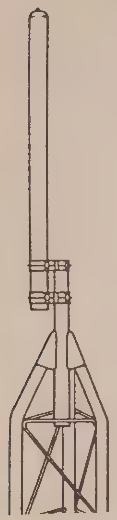


Figure 1a

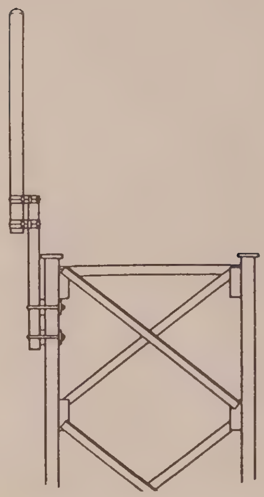


Figure 1b

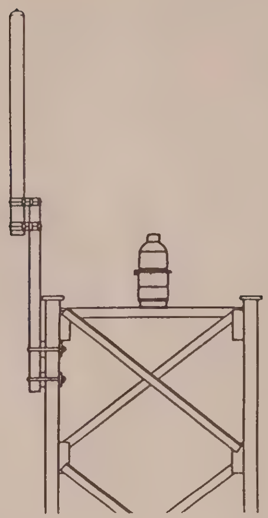


Figure 1c

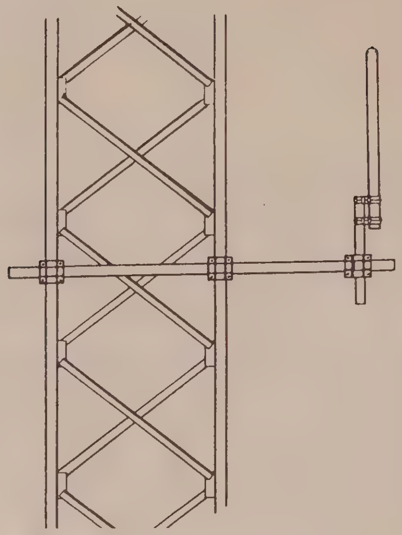


Figure 1d

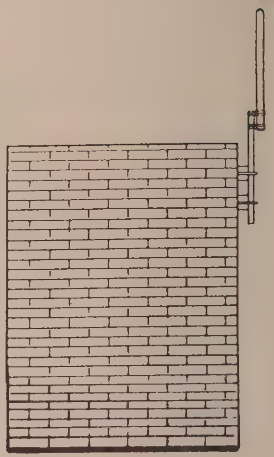


Figure 1e

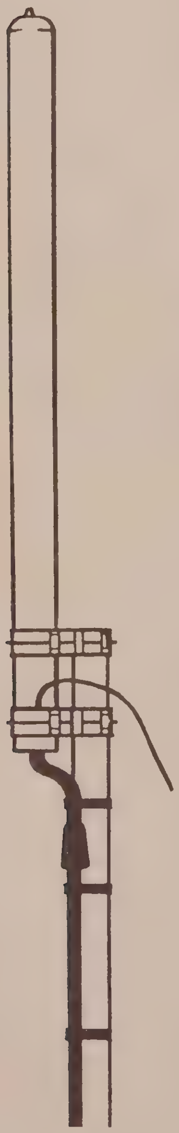


Figure 2

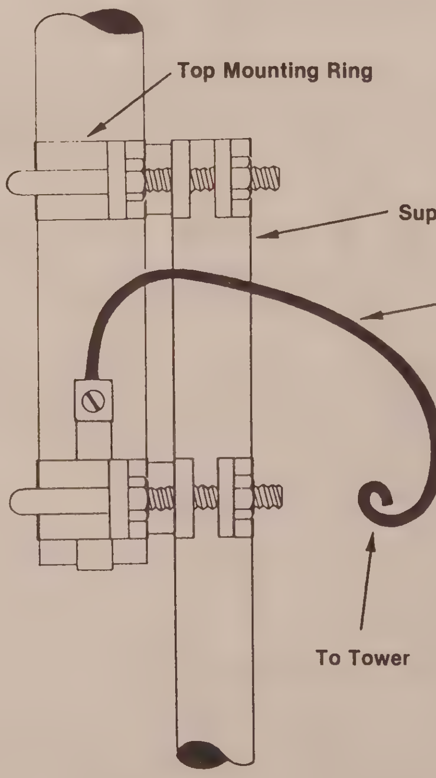


Figure 3

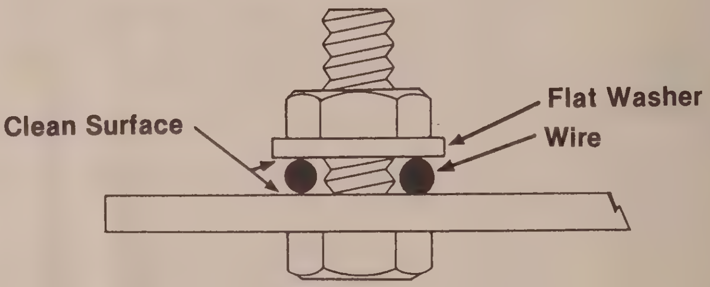


Figure 3a

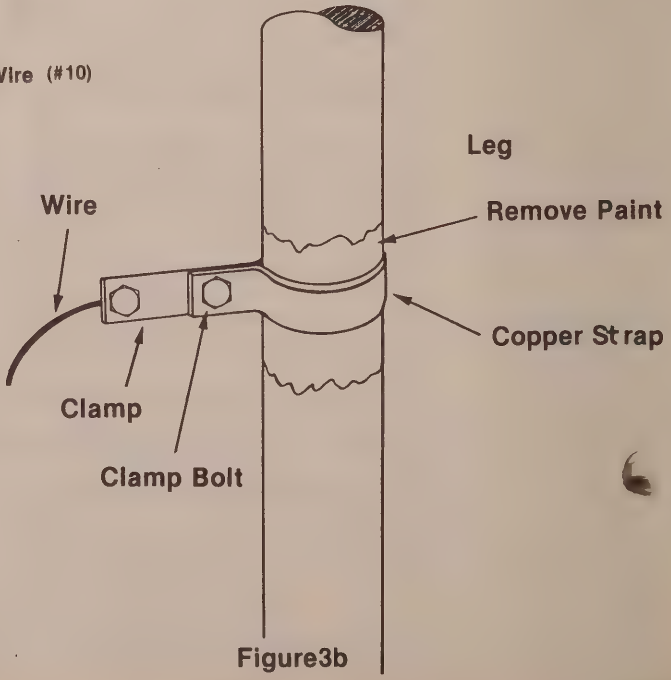
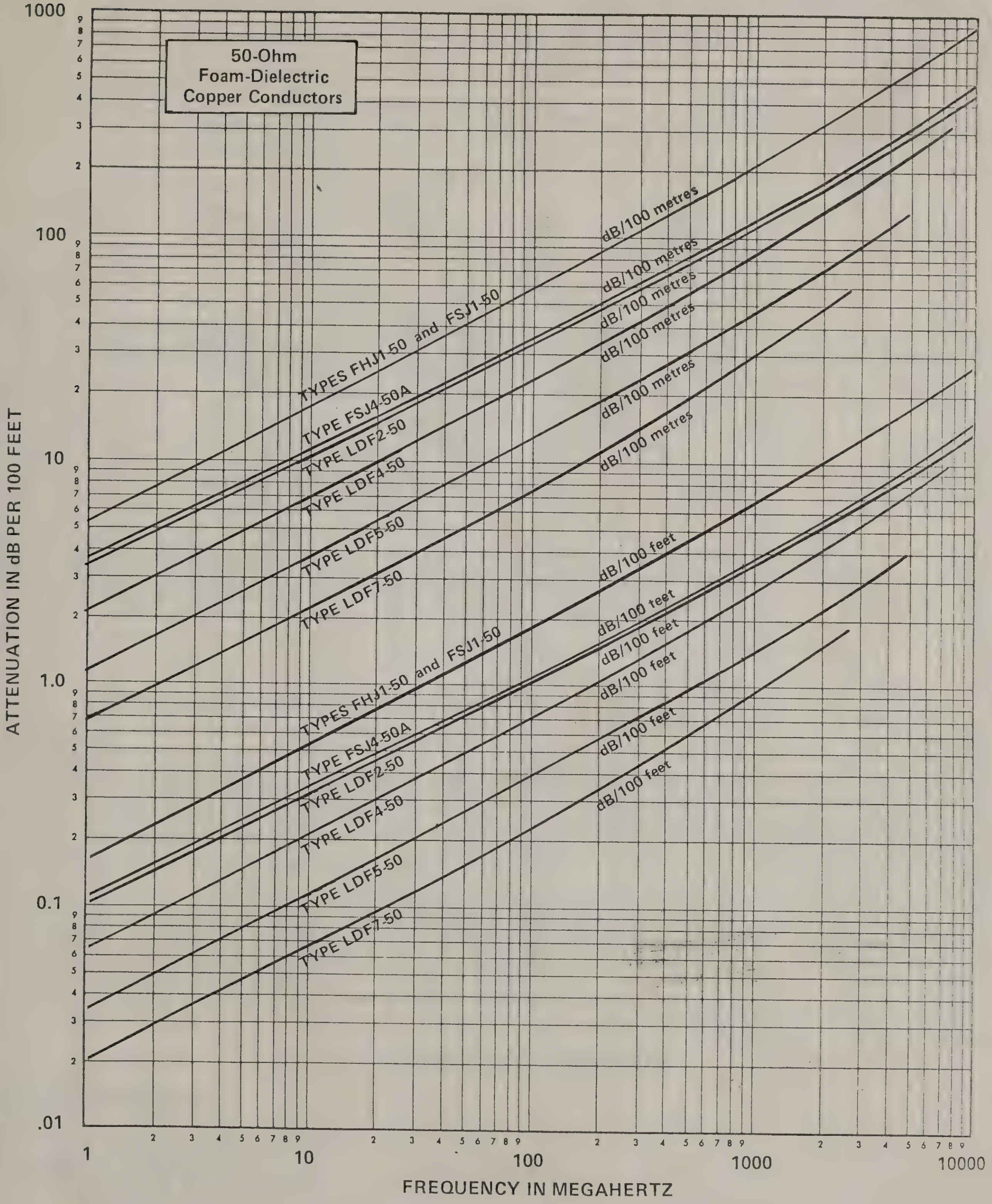


Figure3b

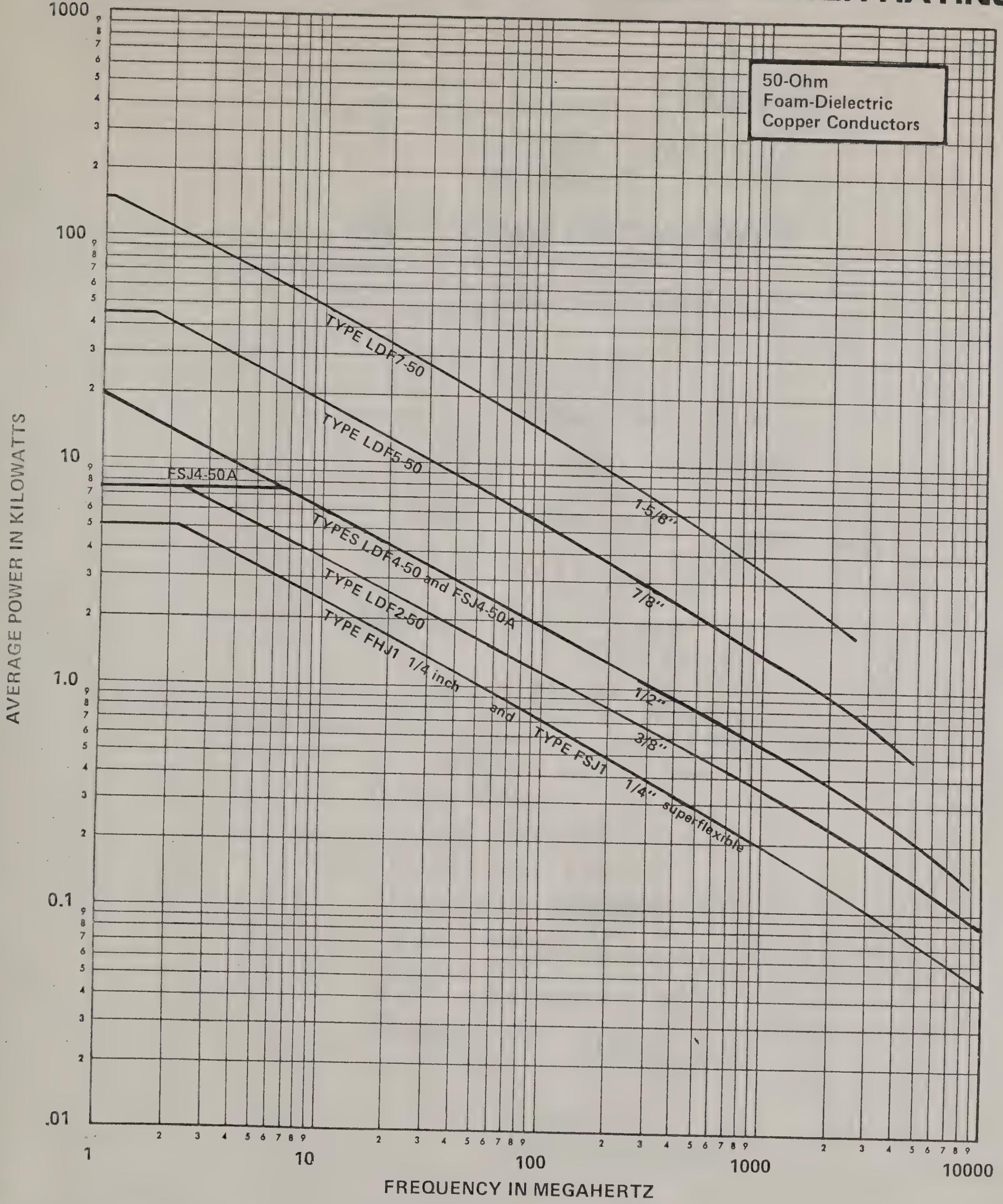
FOAM-DIELECTRIC HELIAX® CABLE ATTENUATION



Attenuation Curves based on:
VSWR 1.0
Ambient temperature 24°C (75°F)

Conversion Data:
For other ambient temperatures, see curve on page 168.

FOAM-DIELECTRIC HELIAX® CABLE POWER RATING



Power Ratings based on:
VSWR 1.0
Ambient temperature 40°C (104°F)
Inner conductor temperature,
LDF Series Cables 100°C (212°F)
Inner conductor temperature,
FHJ1 and FSJ1 Cables 80°C (176°F)

Conversion Data:
For other ambient temperatures, see curve on page 169.

scott Mecherny SCANNING
FLAXAR with DC
RemotE

Southland Electronic Supply
3440 EL CAJON BLVD. SAN DIEGO, CALIF. 92104
PHONE: 283-3941
WHOLESALE ELECTRONIC DISTRIBUTOR

SCAN ON/OFF

Rem1 BLK TWIST with BLUE
Rem2 BLK TWIST with BROWN

F1 LED GRN WIRE } Rem1 AND Rem2
F2 LED WHT WIRE }

BLU F1 F2 Rem 1
BRN F1 F2 Rem 2

WIRE LIST FOR
Rem #2

GRN F1 LED
WHT F2 LED
RED AND BLACK TWIST
AT AND GROUND
BLU SCAN ON OFF
BROWN F1 F2 SW

WINEGARD
TELEVISION SYSTEMS

TB1		TB2	
white/orange	1	same	Ground
white/blue	2	blue/white	Start/stop Scan
green/white	3	white/green	F1/F2 Select
brown/white	4	same	A+
red/blue	5	blue/red	LED 2
gray/white	6	white/gray	LED 1
blank	7	blank	Spare

Remote TB

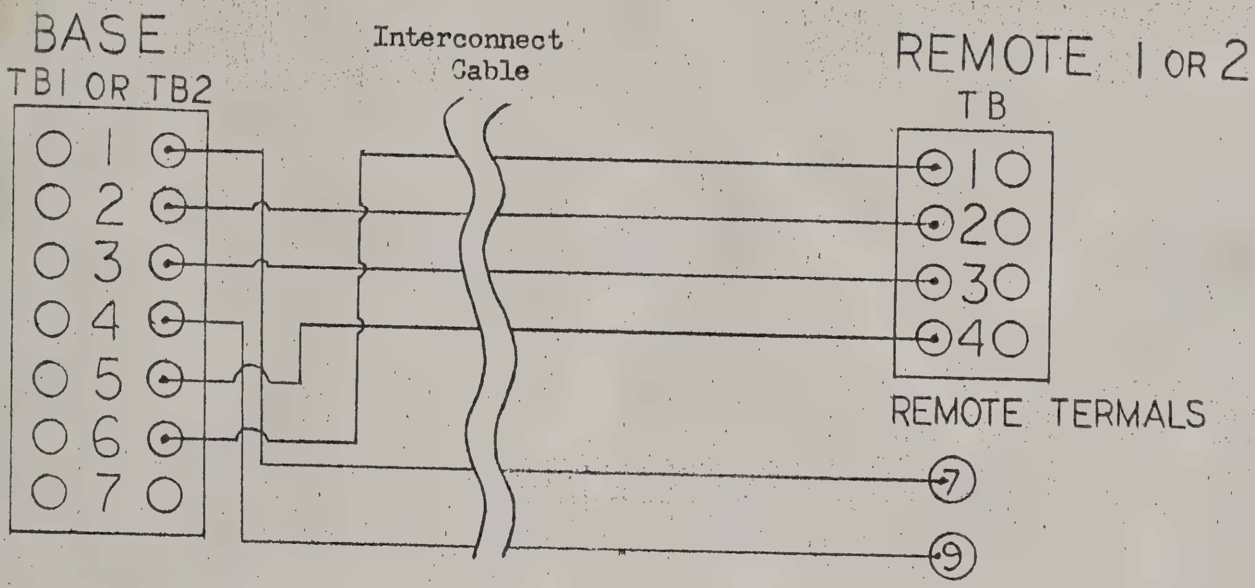
1 = LED 1

2 = Start/Stop Scan

3 = F1/F2 Select

4 = LED 2

Note: A+ and ground must be connected to remote at normal locations.



Note: Connect pins 1,2 & 3 of TB2 together if only one remote is used.

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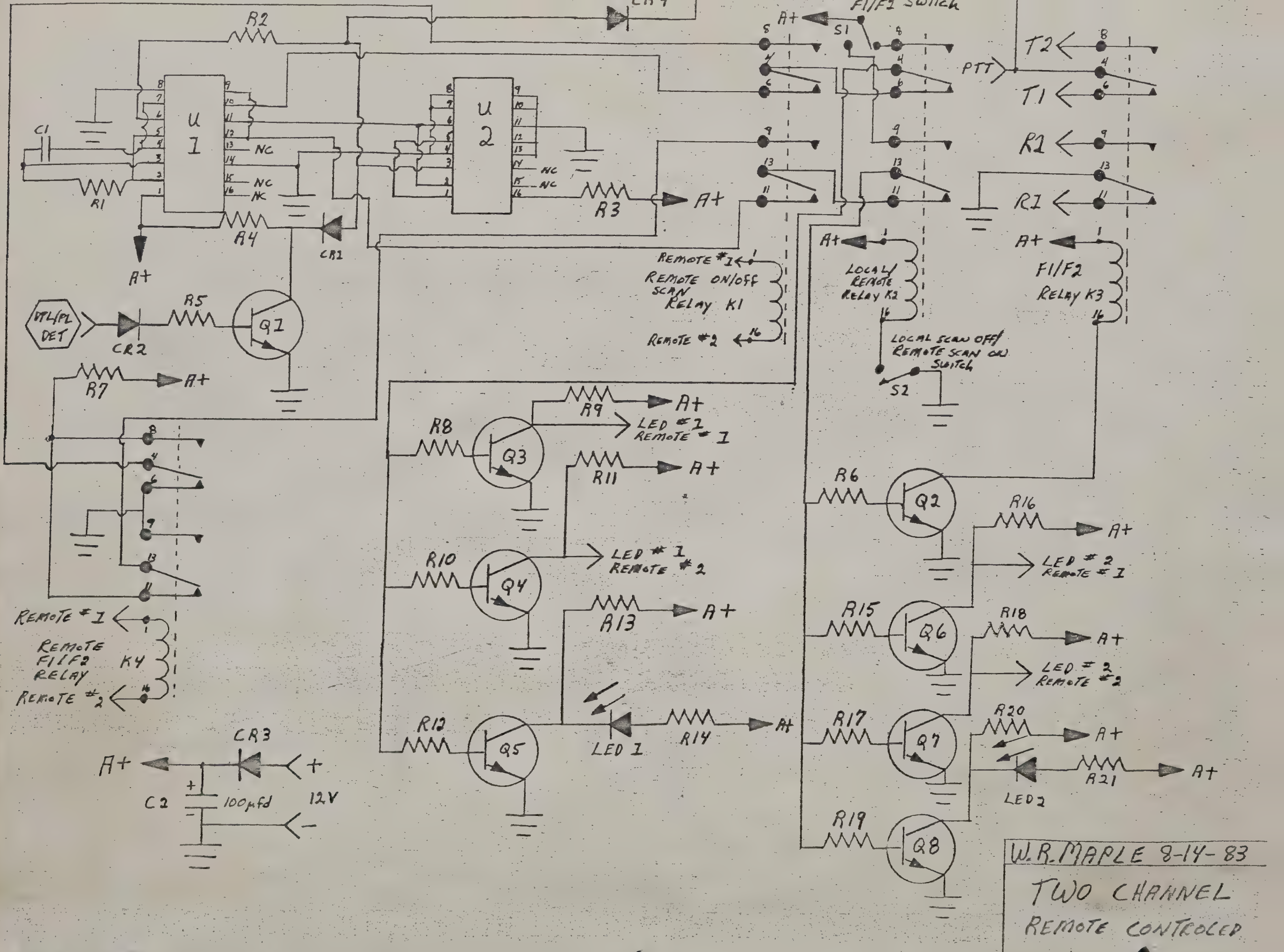
WR MAPLE 8-14-83

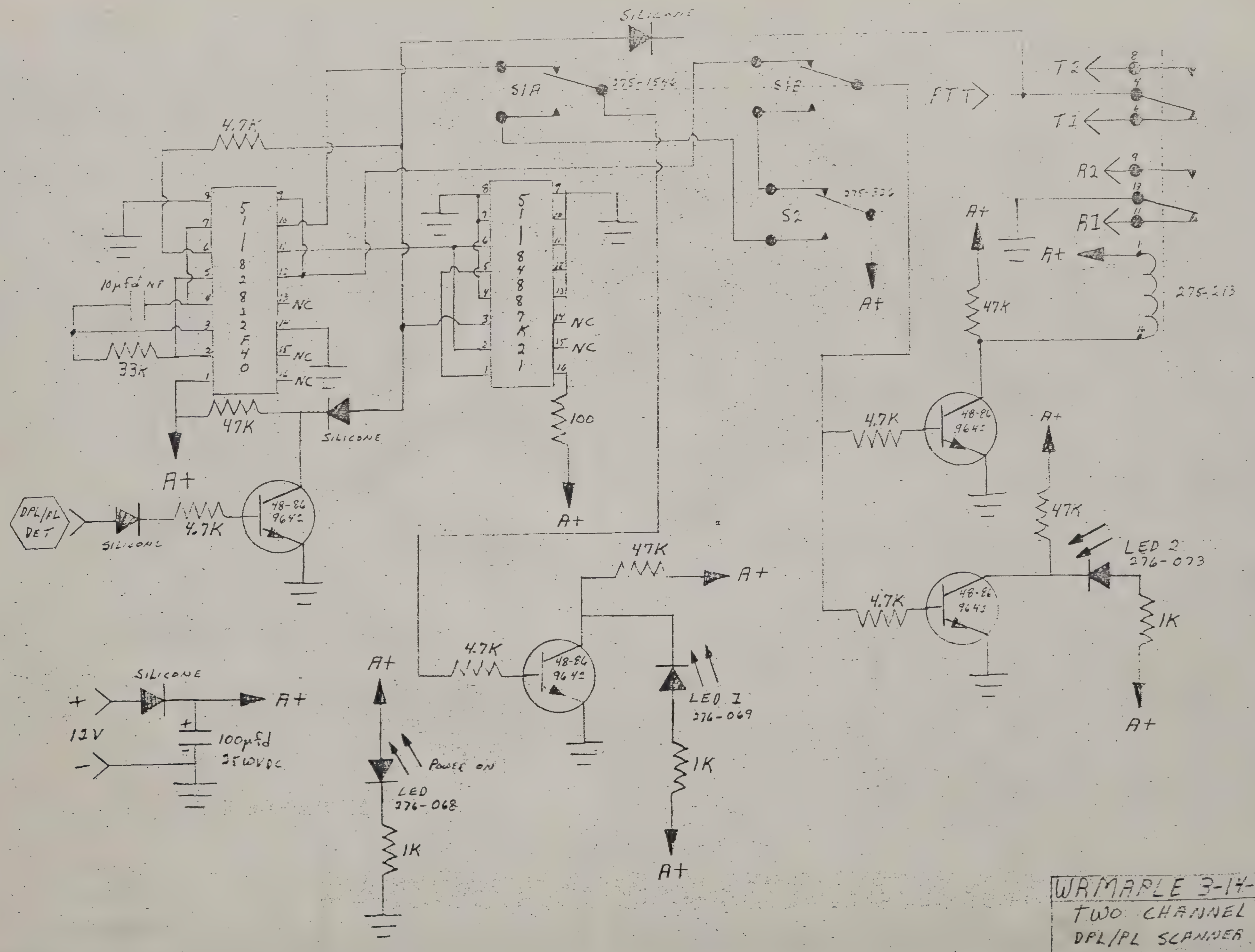
TWO CHANNEL
REMOTE CONTROLED
DPL/PL SCANNER
RCS-150



W.R.MAPLE 8-14-83

TWO CHANNEL
REMOTE CONTROLED
DPL/PL SCANNER
BCS-150

WALTER RAY MAPLE, 1983



WRMAPLE 3-14-84
TWO CHANNEL
DPL/PL SCANNER
Model TCS-200

© 1987 WALTER RAY MAPLE

THE STAR X TRUNKING SCANNER

FOR USE WITH THE MOTOROLA MOSTAR TRUNKED RADIO

DESCRIPTION

The Star X trunking scanner is a separate device which is used with an two system Mostar trunked radio. The scanner enables the radio to monitor both systems of the two system Mostar.

INSTALLATION

Installation of the scanner involves the placement of two jumpers inside the radio as well as a quick connection to the options plug.

OPERATION

Operation of the scanner equipped radio is quite simple. The radios' system select switch must be in postion 1 in order to scan systems 1 and 2, in position 3 to scan systems 3 and 4, and in position 5 to scan systems 5 and 6. When scanning the radio listens to each of the computers in each system. When another unit wishes to talk to the unit equipped with the scanner, he transmits and asks the computer of the system he is using to assign him a channel to use. The computer responds and tells him and the scanner equipped radio to go to a certain channel within that system. Then the mobile units message is transmitted on that channel. When this happens the scanner equipped Mostar allows the message to come through on its speaker. At this instant the scanner stops scanning and locks onto the system being used.

When the scanner stops the LED display on the scanner will display what system is being used. Also when the scanner stops the system being used will be entered into a memory cell inside the scanner. By entering the system last heard the scanner equipped Mostar is able to respond without manauly switching the system select switch to transmit. He just depresses the PTT on the radio microphone and the scanner will enable the Mostar to transmit on the system last heard and when the PTT is released the scanner will remain on that system for approximately fifteen seconds to listen for a response from the other party. After the fifteen seconds the scanner will revert to scan mode.

TRANSMIT SELECTION

All that has been mentioned relating to transmitting has been transmitting on the memory system. However if the operator of the scanner equipped radio wishes to initiate a call on the other of the two systems he must first momentarily depress the radio PTT to see what is in the memory cell and then if that is not the system he wishes to use he must then push the pushbutton switch on the scanner and hold it down until the memory system changes on the display. This will change the memory cell system to the one you want.

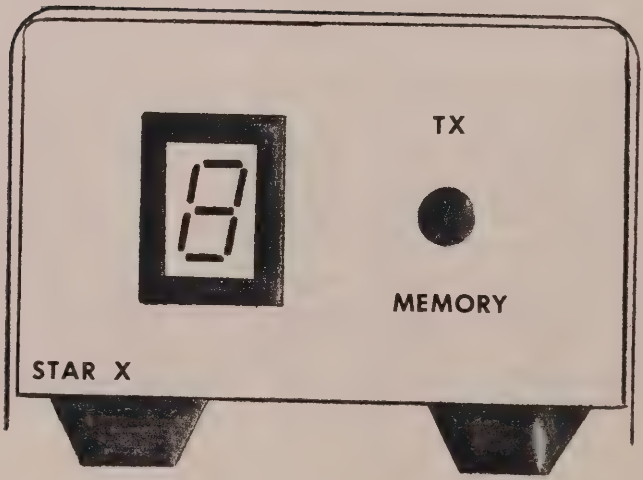
REMOTE ADAPTABILITY

When the scanner equipped Mostar is remoted with a local remote(s) a remote control for the scanner will need to be purchased for each local remote as well as cabling. Specifications for cabling for scanner remote is in the installation instructions.

SPECIFICATIONS

Power- A+ from radio
Scan rate- 1.3 seconds on each system
Current drain- 100 milliamps
Operating temperature- 35 - 150 Degrees farenhiet

Manufactured by J & L Systems San Marcos CA



THE BX II SERIES 2 SYSTEM SCANNER

FOR USE WITH THE MOTOROLA MOSTAR TRUNKED RADIO

DESCRIPTION

The BX II scanner is a separate unit which is affixed to a 2 system Motorola Mostar trunked two-way radio to enable the radio to monitor both systems.

OPERATION

The use of the scanner equipped radio is quite simple. When insalled properly the scanner LED display will follow the scanning action of the scanner by displaying the system it is monitoring. When a call comes in on either system the scanner will stop on the system being used and display it on the LED. This allows the user of the scanner to know what system to talk back on. Now all the user of the scanner equipped mostar has to do is switch to the appropiate system on the system selector switch on the radio and transmit. By depressing the radios transmit button the scanner is told to shut off for about 20 seconds. This shut off action is so the scanner does not interfere with the conversation. To resume scan the radios selector switch must be in position 1. The scanner is also equipped with an on/off switch so the user can listen to just one system if he or she wishes.

INSTALLATION

Installation of the BX II series scanner involves the placment of two jumpers inside the radio as well as a quick connection to the radios options plug(approximately 15 minutes).

SPECIFICATIONS

Power source - +12dc from the mostar option plug
Current drain - approximately 75milliamps
Scan rate - 1.3 seconds each system
Temperature - 35-150 degrees F

Manufactured by J & L SYSTEMS San Marcos CA

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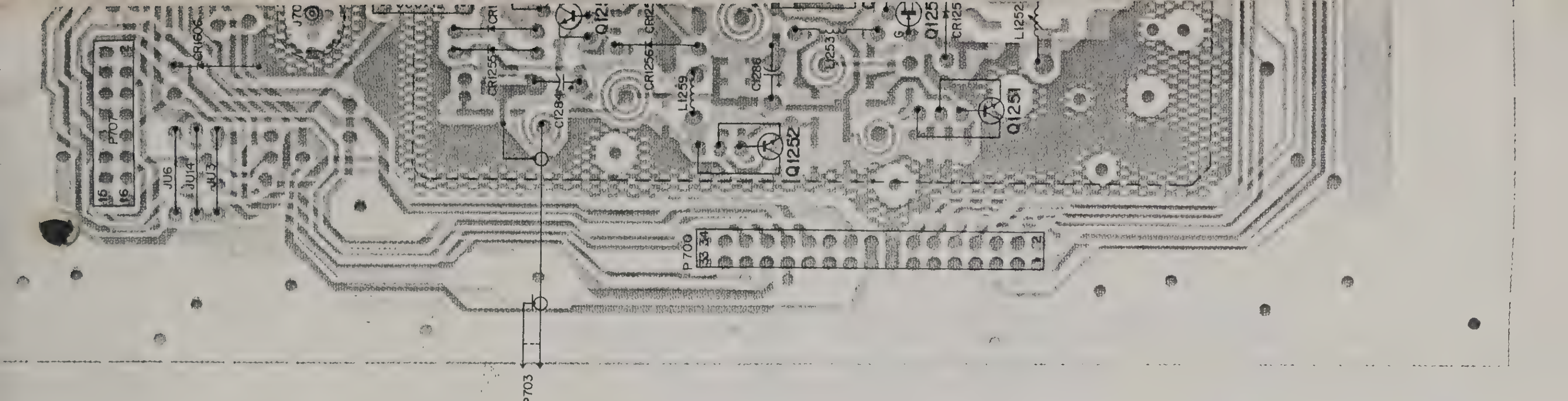
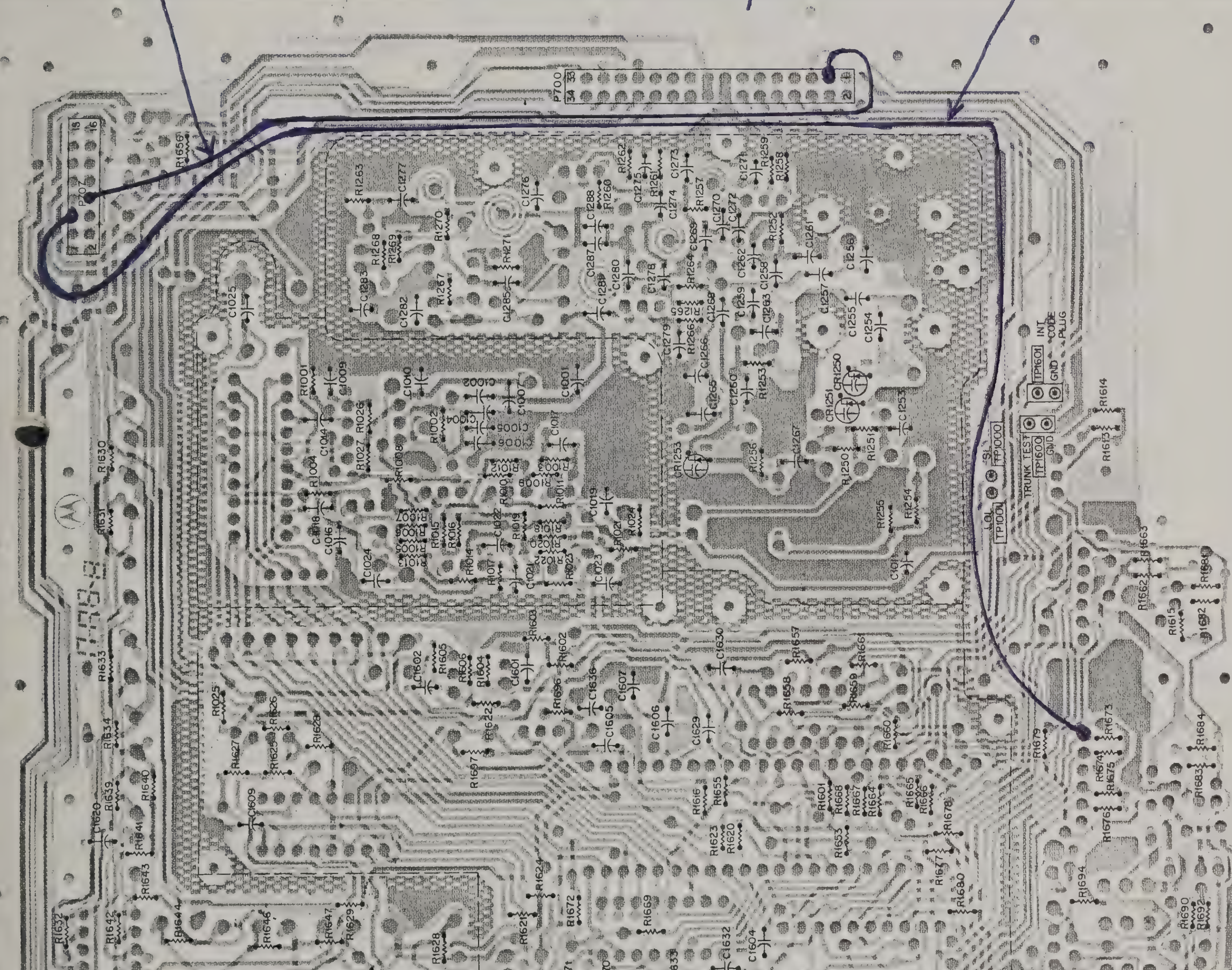


A wire 5½"

Scanner Jumpers

B wire 10¼"



Schematic, Circuit Board Diagrams, and
Parts Lists for the

SCANNER INSTALLATION INSTRUCTIONS

For BX, TX, BXII, + STARX
Trunking Scanners

1. Installation involves the placement of jumpers on the trunked Command board, 2 jumpers in all.
(a) The first jumper is placed From pin 3 on P700 to pin 8 on P707
(b) The Second jumper is placed From pin 1 on the System select switch to pin 5 of P707
NOTE! use Teflon insulated wire or other wire with a high temperature tolerance (The inside of a mostar will get very hot under normal use).

2. Please refer to Jumper diagram Enclosed with the (a) wire being 5½" and (b) wire being 10¼"

3. Plug the scanner into the Mostar thru the options plug. The plug connector on the scanner cable already has the SPKR Jumper in it, so there is no need for it inside the radio.

ADJUSTMENTS

The only adjustment which may be necessary is the setting of the scan rate. This is preset at 1.2 sec per System. ~~In the case of~~ In case the Scan rate should be adjusted this can be accomplished by turning the Pot inside the scanner and timing it with a stop watch or wrist watch.

MOTOROLA INC.
Communications
Group

NCPD

DISGUISE STYLE MOBILE ANTENNAS

(FOR FORD/MERCURY CARS)
39-50 MHz
144-174 MHz
406-512 MHz

1. DESCRIPTION

The disguise style antennas are two-way mobile radio antennas that resemble the broadcast band receiver antennas used by the automobile manufacturer. Models are described in Table 1. Refer to Figure 1 for parts identification.

NOTE

This antenna is designed to function satisfactorily at the frequency specified on the package and no further adjustments should be necessary.

Table 1. Disguise Antenna Models

Model Number	Frequency Range (MHz)	Description
RRA4069A	39-50	Quarter-wave Antenna
RRA4070A	39-50	40-inch Antenna
RRA4420A	144-174	Quarter-wave Antenna
RRA4421A	144-174	2.5dB Gain Antenna
RRA4664A	406-512	2.5dB Gain Antenna

2. INSTALLATION

2.1 REMOVAL OF EXISTING ANTENNA

Remove the existing antenna and cable. Measure the hole used for mounting the antenna. Follow the procedure given below for the hole size measured.

2.2 PROCEDURE FOR 7/8″ HOLE

Step 1. Route rf cable from two-way radio to antenna location. Note that rf cable and connector are not supplied with the antenna.

Step 2. Thread the rf cable connector onto the support tube. Use a stub cable (if one is supplied) between the rf connector and the support tube.

Step 3. Wrap the connector(s) with plastic electrical tape for waterproofing.

Step 4. Install bottom support and support tube from inside of fender.

Step 5. Place rubber pad, trim plate, top support, and dress nut over the support tube and mounting hole.

Step 6. Thread and tighten dress nut onto support tube.

Step 7. Screw whip into mount and tighten securely.

Step 8. Connect rf cable to two-way radio.

2.3 PROCEDURE FOR 15/16″ HOLE

Step 1. Perform Steps 1 through 3 in the procedure for a 7/8″ hole.

Step 2. Temporarily screw the dress nut and whip onto the support tube.

Step 3. Use the whip to guide the support tube and bottom support downward through the hole.

Step 4. Remove the whip and dress nut, being careful not to let the support tube fall into the mounting hole.

Step 5. Perform Steps 5 through 8 in the procedure for 7/8″ hole.

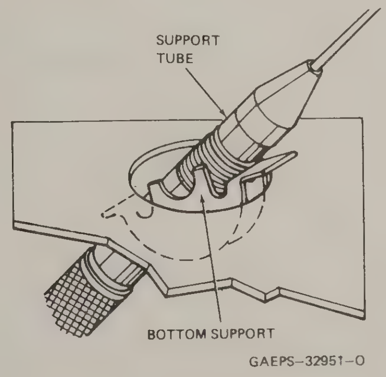


Figure 2. Inserting the Bottom Support

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technical writing services
1301 E. Algonquin Road, Schaumburg, Il. 60196

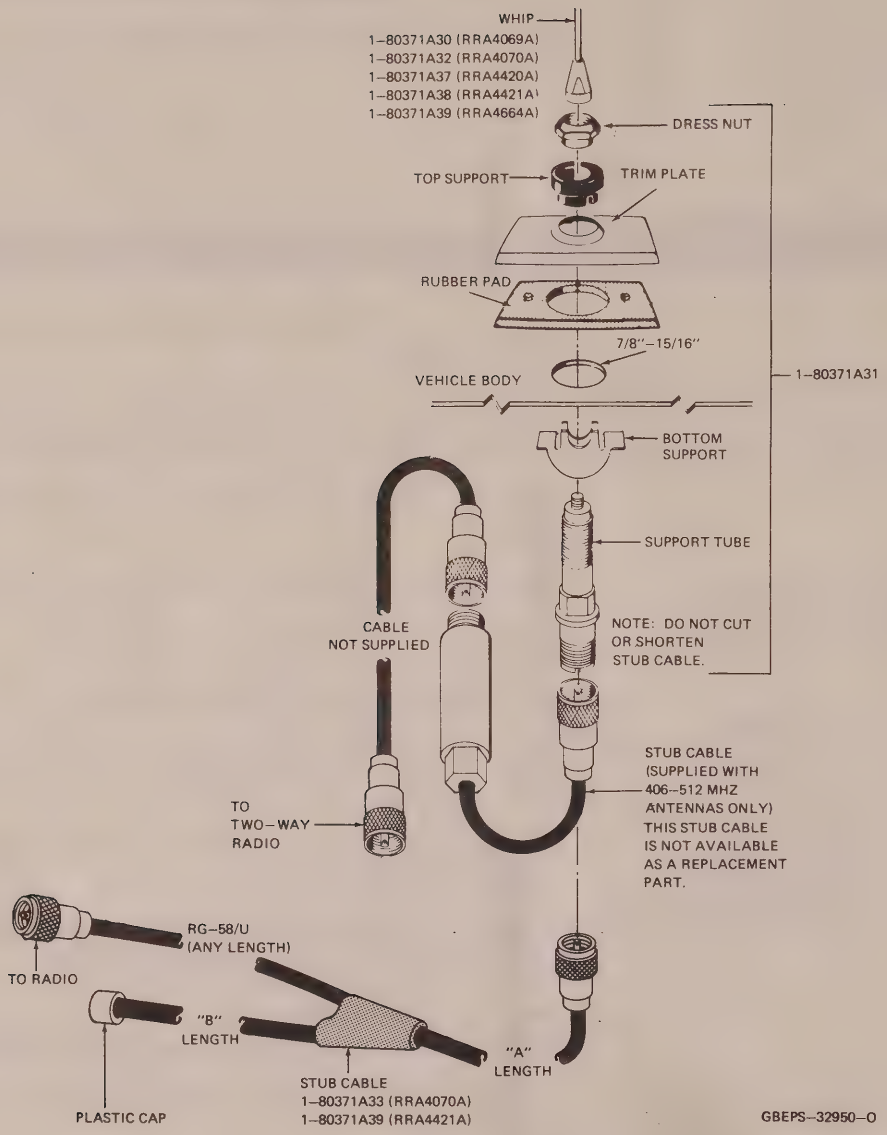


Figure 1. Parts Identification

MOTOROLA RECOMMENDATIONS FOR MOBILE ANTENNA LOCATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic safety standard which applies to the use of mobile radios. Proper installation and use of this antenna will result in exposure below the OSHA Limit.

Antennas must be installed at least two feet* (0.6 meter) from vehicle operators and passengers unless shielded by a metallic surface.

Motorola recommends that mobile antennas be located as follows:

Standard metal passenger vehicles	Center roof or center trunk lid
Vans, pickups, and other light trucks (metal roofs)	Center roof
Heavy duty equipment with metal roofs (heavy duty trucks, semi-tractors, heavy refuse trucks, cement mixer trucks)	Center cab roof
Specialty vehicles (such as T-roofs, sun roofs, or convertibles)	Center trunk lid
Other vehicles	Contact your Motorola Field Technical Representative. Do not install closer than two feet or without proper antenna ground plane.

(Gutter mount antennas are not recommended for transmitters of more than 6 watts.)

* Motorcycle and Industrial Dispatcher radios—one foot (0.3 meter) for transmitters of 30 watts or less.

EPS-29456-O

5617

INSTRUCTION BOOK

FOR

PD-497

DUPLEXER

(144-174MHz)

SERIAL No. ____________

TRANSMIT ____________

RECEIVE ____________

CELWAVE R.F. INC.

MARLBORO, N.J. PHOENIX, AZ.

CEL-21

REV #1

DUPLEXER PD-497

DESCRIPTION

This duplexer consists of six PD-505 pass-notch resonators arranged with three in each of the two channels. The unit may be used at spacings from 500 KHz to 7 MHz in the 144-174 MHz frequency range. A minimum isolation of 85 dB is provided in each of the two channels at 500 KHz separation. Insertion loss is less than 1 dB under these conditions. Each resonator has two adjustments. The larger central adjustment moves both the pass and notch frequencies, while the off-center smaller adjusting screw controls the pass-notch spacing. Any resonator may be adjusted to place the rejection notch on either side of the pass frequency.

TUNING INSTRUCTIONS

The units are normally supplied tuned to the desired frequencies and no readjustment should be required unless there has been a change in frequency.

The following equipment will be required to tune the duplexer:

1. A 50 ohm signal generator with variable attenuator which covers the desired transmit and receive frequencies.
2. A 50 ohm input receiver tuned to the desired transmit frequency.
3. A 50 ohm input receiver tuned to the desired receive frequency.
4. Two six dB attenuators to place in the lines to the receivers.

NOTE: Separate transmitter and receiver cables to duplexer to maintain isolation. Separation to be twelve inches minimum. The use of double shielded or solid outer jacket cable is strongly recommended.

The reject or notch frequency will maintain its spacing to the pass frequency when the pass adjustment of a cavity (the large central screw) is moved several MHz. For example, a system operating at 152 and 153 which is moved to 154 and 155 will require a minimum of readjustment if the pass adjustment is made first. It is, therefore, recommended that the pass adjustments be made first and that the following step by step procedure be adhered to:

Locate the transmitter channel of the duplexer. Remove the cables from

the individual resonators and set them aside. The resonators are to be tuned individually and then recabled together after tuning.

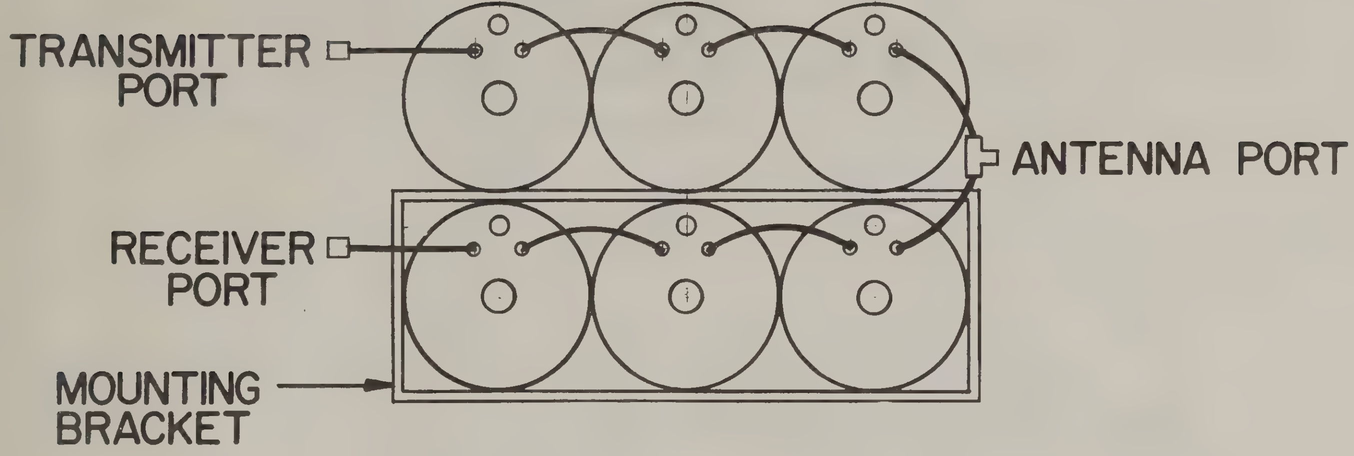
1. Connect the three resonators, one by one, between the generator and a receiver tuned to the transmitter frequency and turn the large central tuning screw for maximum transfer of signal at the transmitter frequency.
2. Now connect the three resonators, one by one, between the generator and a receiver tuned to the receiver frequency and tune the off-center notching adjustment for minimum transfer of signal at the receiver frequency.

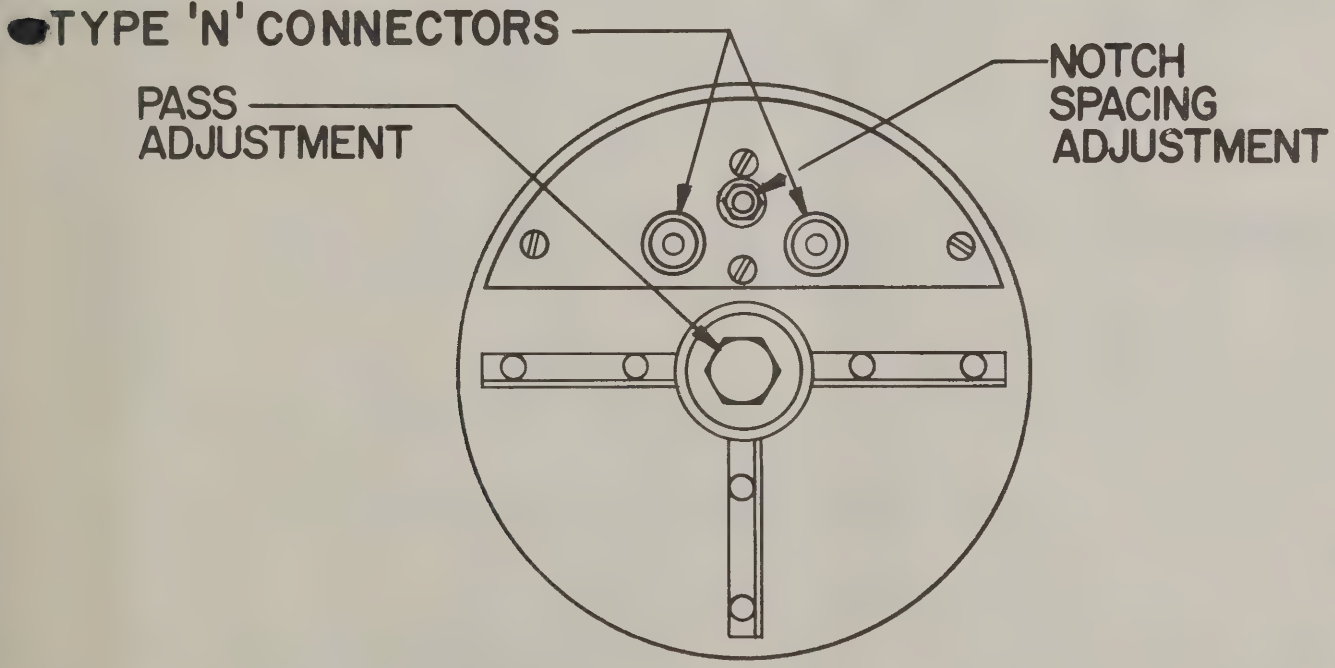
NOTE: ADJUST SIGNAL GENERATOR OUTPUT TO PREVENT RECEIVER OVERLOAD THROUGHOUT THE ADJUSTMENT PROCEDURE.

3. Repeat steps No. 1 and 2 on all three transmitter resonators, especially if the pass frequency has been moved more than 3 MHz or the pass-stop spacing changed significantly.
4. Repeat step No. 1 in receiver channel after removing interconnecting cables from the three resonators. Tune for maximum signal transfer at the receiver frequency.
5. Repeat step No. 2 in the receiver channel. Tune the three resonators for minimum signal at the transmitter frequency.
6. Repeat Steps No. 4 and 5.
7. The last adjsutment to be made on any of the resonators is the notching adjustment. For example, when repeating steps No. 1 and 2 they should be repeated in that order. The same applies to repeating steps 4 and 5.

The cable harness may now be reconnected and the unit placed into operation. All the interconnecting cables and cables to the antenna "tee" are equal length.

FRONT VIEW OF DUPLEXER WIRING





SINGLE CAVITY

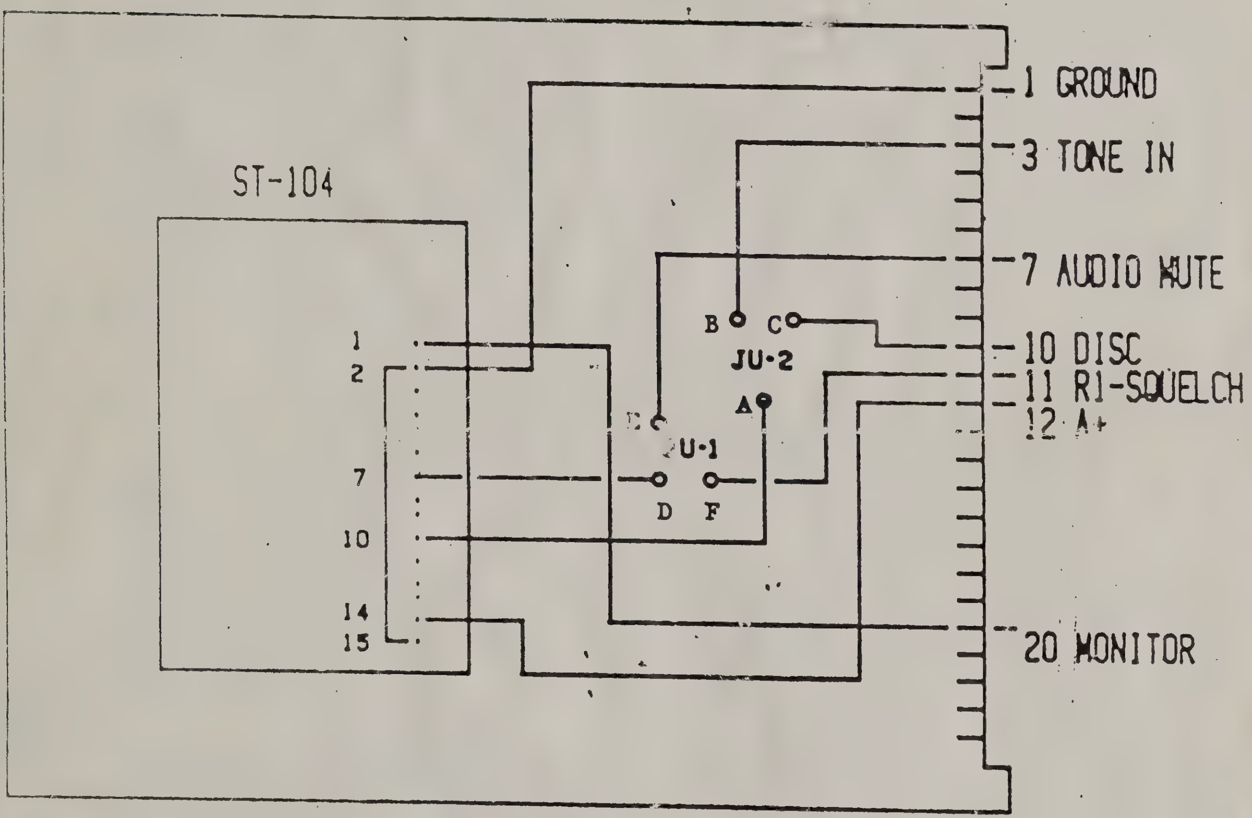
CONNECT TONE DECODER TUNING INSTRUCTIONS

Turn PL monitor switch on station control module to monitor

Connect frequency counter to front test pin

Adjust frequency to connect tone frequency through front hole

Restore monitor switch to normal position

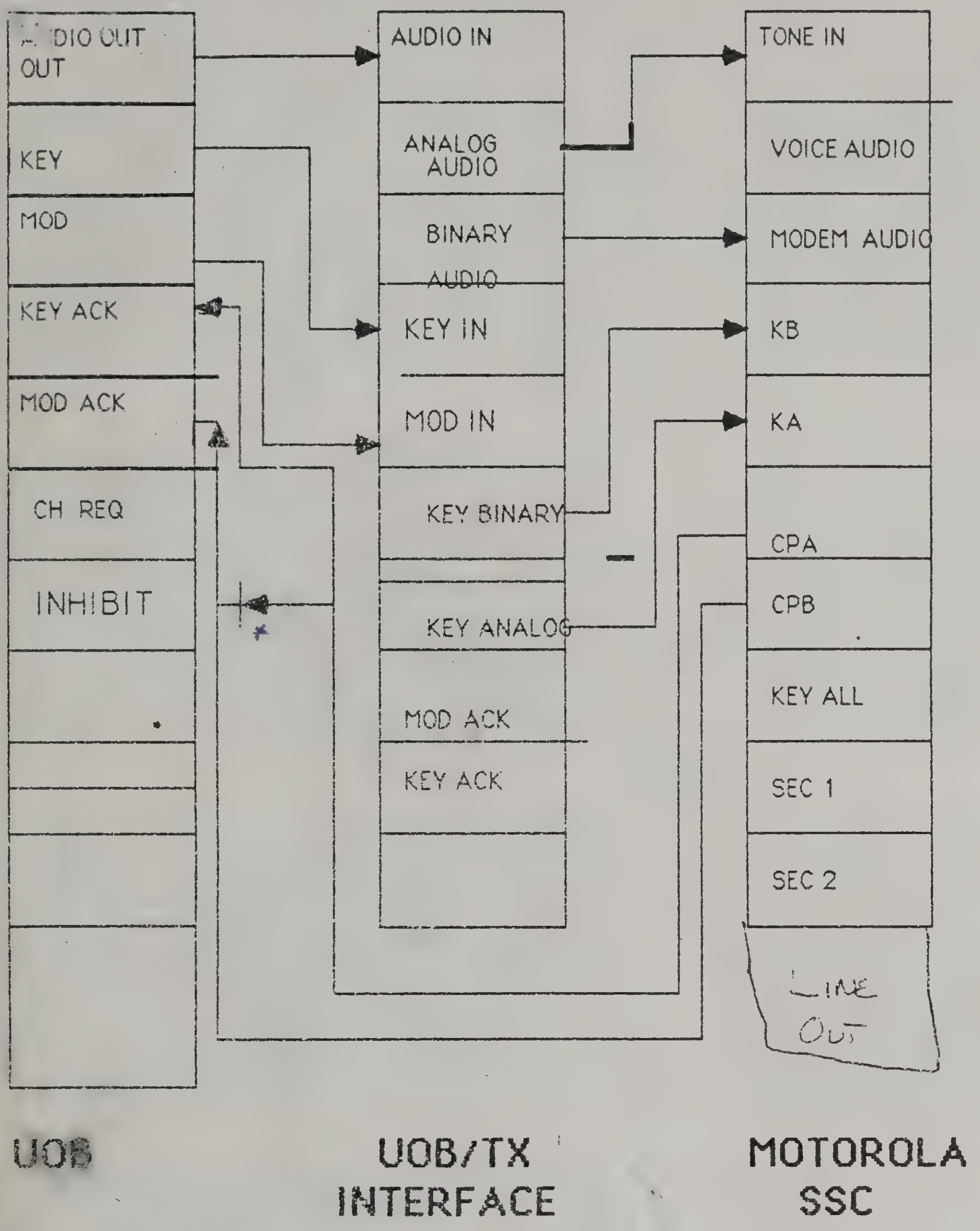


CONNECT TONE DECODER INSTALLATION INSTRUCTIONS

A to B
D to E
Normal Trunking

Jumper on rear of motherboard

Slot 12		Slot 11
Trunk		Connect
Control	TO	Tone
Module		Decoder
Pin		Pin
15		7



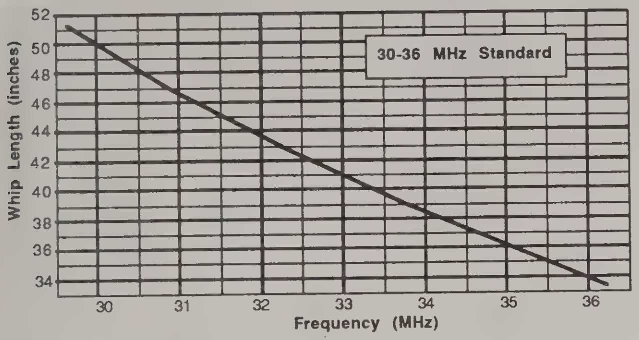
* IMPORTANT

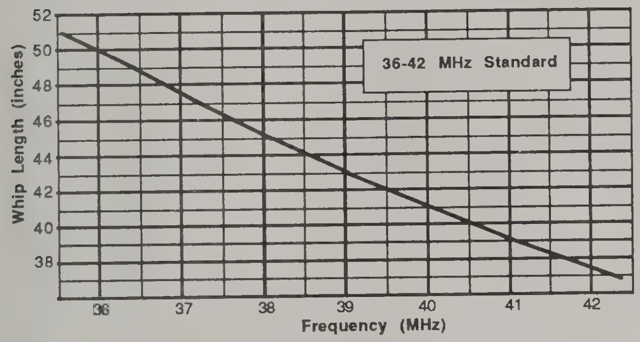
SCE TO MOTOROLA SSC

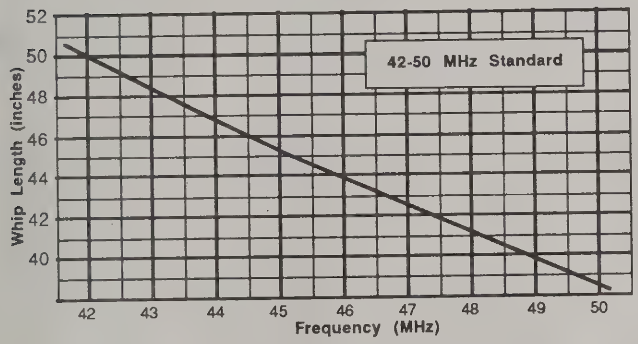
SPECTRUM™ by MOTOROLA

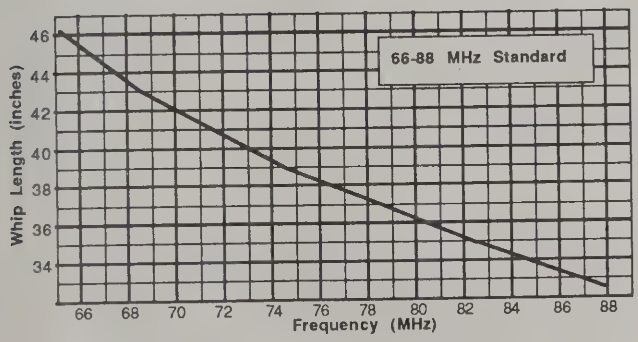
Cutting Chart lengths are approximate. Whip length will vary with type of vehicle, mount location, and type of mount. Cut 1-1/2 inches longer than chart length, then trim for minimum reflected power.

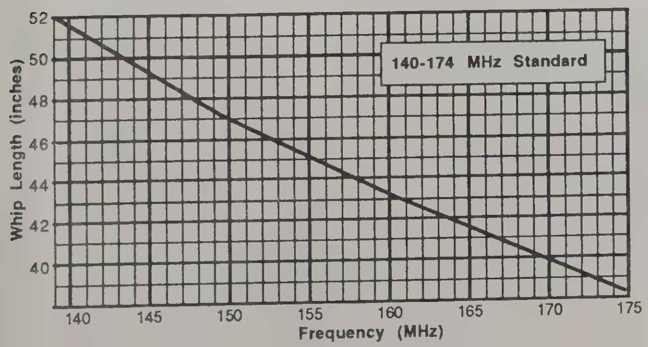
STANDARD (No Spring)



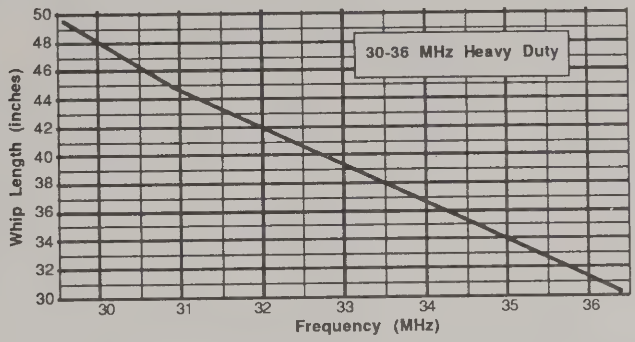


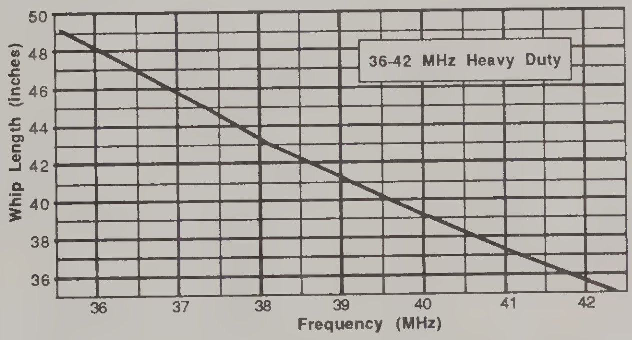


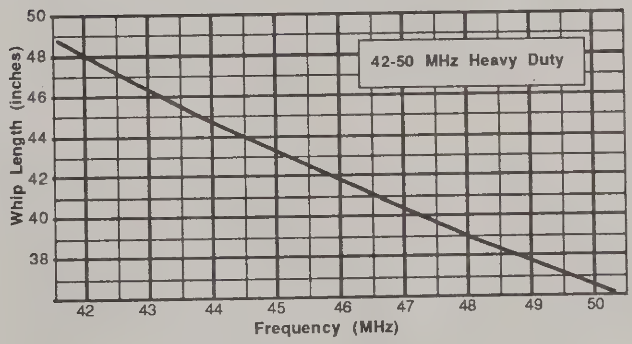




HEAVY DUTY (Spring)







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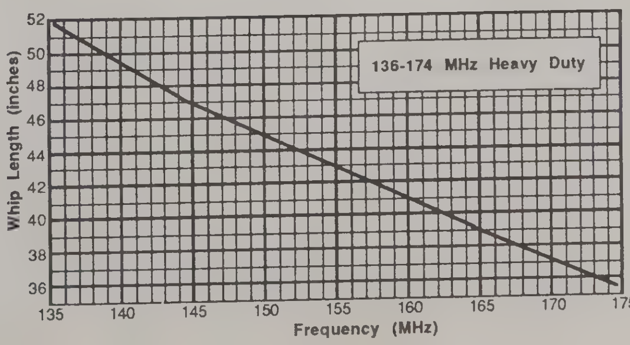

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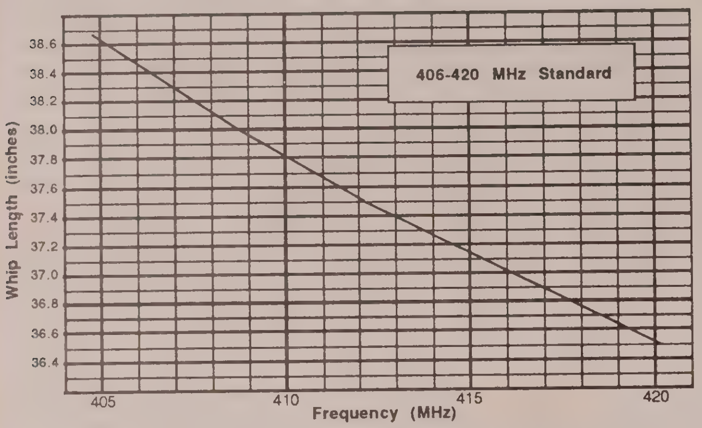
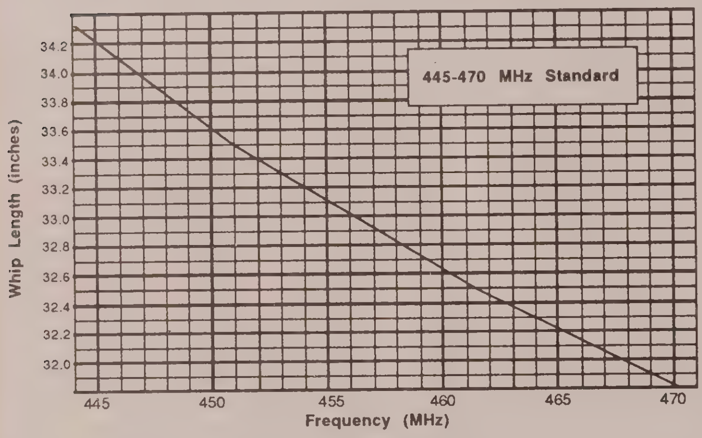
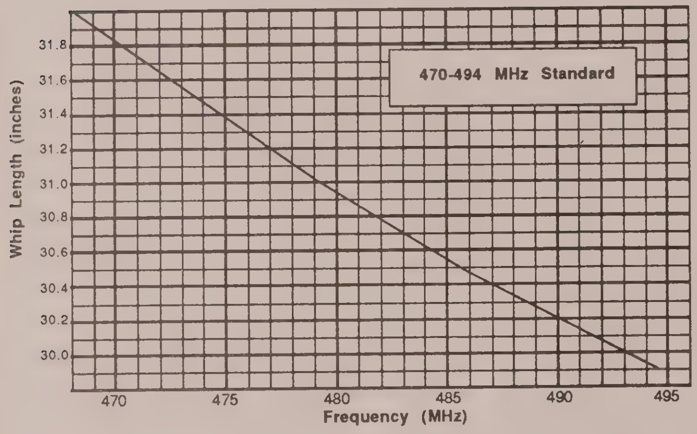
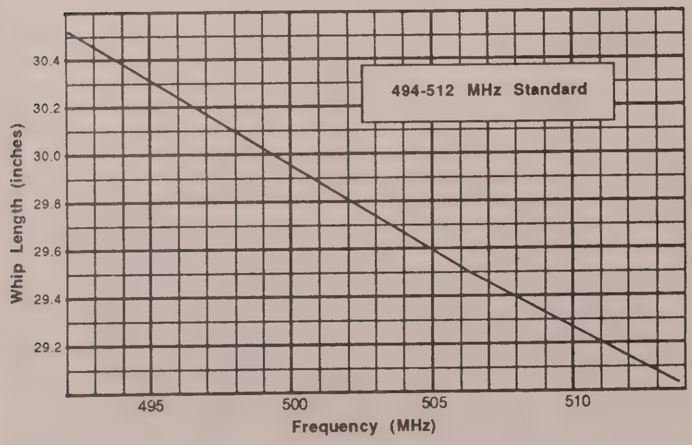
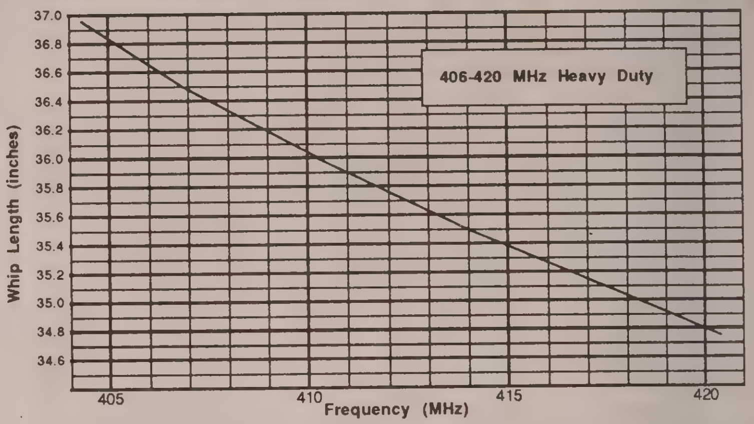


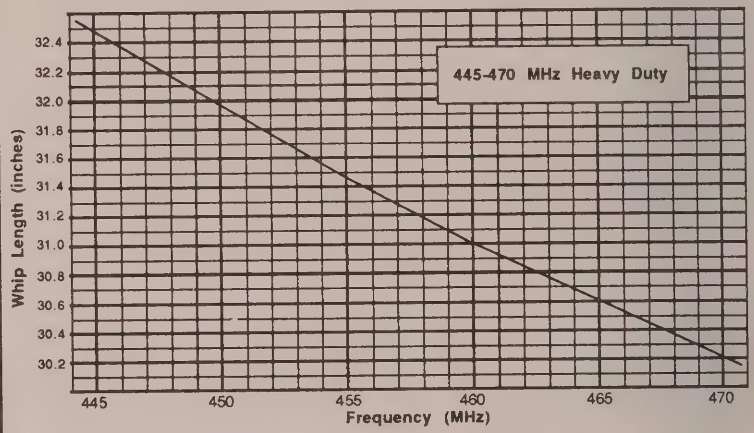


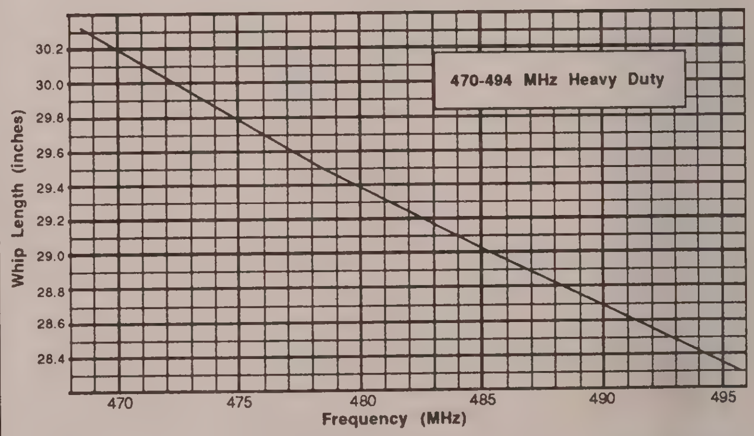


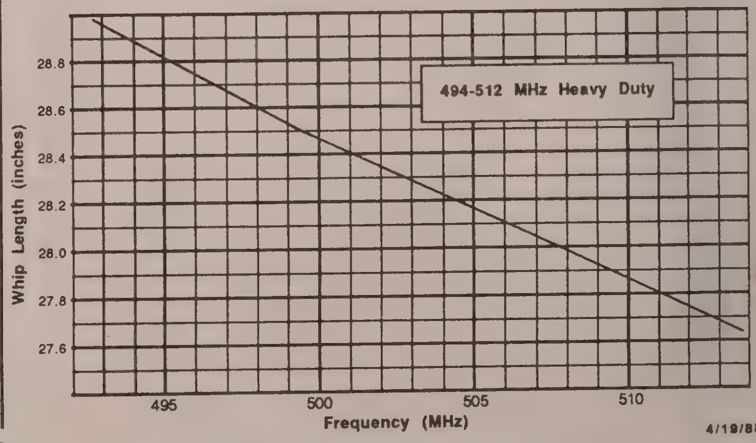


HEAVY DUTY (Spring)









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NEXT ASSY

JOB NO. LM09,
QUANTITY 1
S/O NO. 508995,
CUSTOMER Quigley Comm.

This is to certify that these units, Model L2328, have been tested 100% and are within the specification limits below:

Customer Spec L2328 Rev
Frequency Range Fo 858.700 ~~to~~ ± 10MHZ
Isolation Spec 50 dB Min.
Ins. Loss Spec .5 dB Max.
VSWR Spec 1.25 Max.

Serial No's. 253 thru inclusive.

CRR

Serial No's.

Tested By Tom W.
Date 5-16-89

Q. C. Approval
Date

Loomis MCSMR

DIST.

REVISIONS

DO NOT SCALE THIS DRAWING

M/A SPECIFICATION S100-101 APPLIES

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON

DECIMALS	ANGLES
.X ± .1 .XX ± .02 .XXX ± .005	0° - 30'

UNLESS OTHERWISE SPECIFIED 63 ALL OVER
MATERIAL SEE NOTE
FINISH SEE NOTE

		DATE
DRAWN		
CHECKED		
ENG.APP'D		
PROD.APP'D		

MICROWAVE ASSOCIATES, INC.
BURLINGTON, MASSACHUSETTS

TITLE
TEST DATA SHEET

SIZE	CODE IDENT NO.	DRAWING NO.
A	96341	

SCALE /	WGT.	SHEET 1 OF

SPECTRUM™ SERIES
BASE LOADED MOBILE ANTENNAS
Manufactured by MOTOROLA

*** ANTENNA INSTALLATION**
*** MOUNTING INSTRUCTIONS**
*** CUTTING CHARTS**
*** REPLACEMENT PARTS**
*** CONNECTOR INSTRUCTIONS**

Read all instructions carefully before starting the installation.

THANK YOU

Thank you for selecting the Spectrum mobile antenna.

The Spectrum antennas have been designed to withstand demanding and rugged environments. During the design phase, the antennas went through extensive Accelerated Life Testing (ALT), which simulates years of in-field service. As a result, potential problems are designed out, helping ensure that the antennas you receive will give you years of dependable performance.

DANGER
ANTENNA CONTACT WITH
HIGH VOLTAGE WIRES
MAY RESULT IN DEATH
FROM ELECTROCUTION

BEFORE YOU START

SAFETY PRECAUTIONS
FOR MOTOR VEHICLE USE ONLY

1. SAFE ANTENNA INSTALLATION
Be sure to mount the antenna on a horizontal surface to keep the antenna as vertical as possible, thus preventing the antenna from protruding beyond the vehicle and causing bodily injury and/or property damage.

2. ENTERING GARAGES
Remove the antenna from the vehicle when entering a garage, preventing damage to the vehicle and the antenna whip/ball from damaging overhead light fixtures, and garage doors.

3. AUTOMATIC CARWASH
To prevent damage to the antenna/vehicle, antenna assembly should be removed from the vehicle before entering the automatic carwash. Antenna contact must be wiped dry to prevent moisture from damaging the contact.

MOTOROLA
COMMUNICATIONS PARTS DIVISION
1313 E. Algonquin Rd.
Schaumburg, Illinois 60196
To Order Call Toll-Free 1-800-422-4210

68-80309C12-A
4/26/88 MG

WHERE TO MOUNT THE ANTENNA

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic safety standard which applies to the use of mobile radios. Proper installation and use of this antenna will result in exposure below the OSHA limit.

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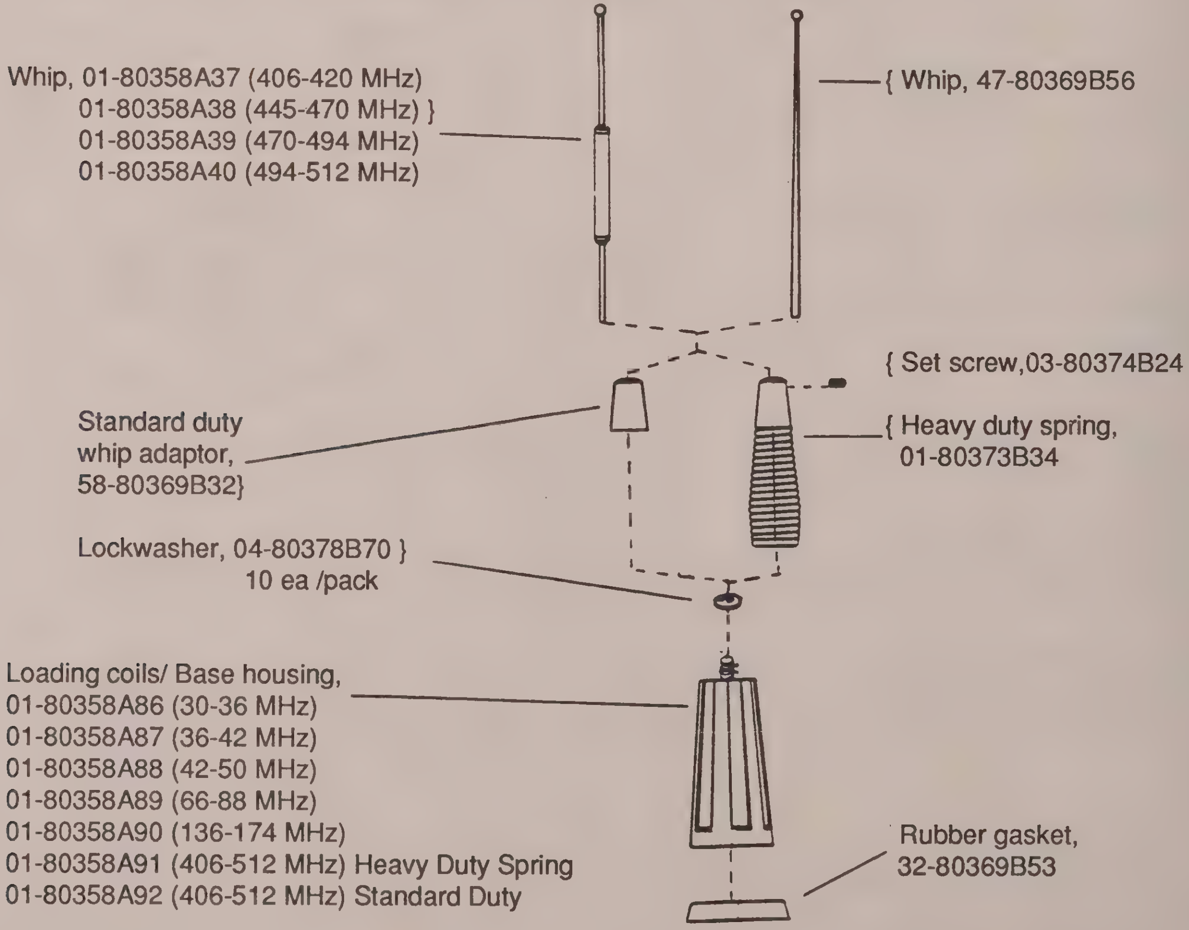
Standard metal passenger vehicles	Center roof or center trunk lid
Vans, pickups, and other light trucks (metal roofs)	Center roof
Heavy duty equipment with metal roofs (heavy duty trucks, semi-tractors, heavy refuse trucks, cement mixer trucks)	Center cab roof
Specialty vehicles (such as T-roofs, sun roofs, or convertibles)	Center trunk lid
Other vehicles	Contact your Motorola Field Technical Representative. *Do not install closer than two feet from occupants or without proper antenna ground plane.*

ANTENNA ASSEMBLY INSTRUCTIONS

If antenna mount has not been installed, refer to the Antenna Mount Installation Instructions. Assemble the antenna assembly (except the whip) onto the mounting base, as shown in Figure 1.

1. Place lockwasher on stud of loading coil/ base housing.
2. Assemble either the standard duty or heavy duty spring adaptor to the base housing assembly by threading onto the housing stud with the lockwasher already in place.
3. Hand tighten the adaptor until the lockwasher is fully compressed.
4. Press rubber gasket onto the bottom of the coil housing.
5. Do not insert the antenna whip into the antenna adaptor at this time. Refer to the Tuning the Antenna Section, for further instructions.


Whip, 01-80358A37 (406-420 MHz)
01-80358A38 (445-470 MHz) }
01-80358A39 (470-494 MHz)
01-80358A40 (494-512 MHz)
{ Whip, 47-80369B56
{ Set screw,03-80374B24
Standard duty whip adaptor, 58-80369B32}
{ Heavy duty spring, 01-80373B34
Lockwasher, 04-80378B70 }
10 ea /pack
Loading coils/ Base housing,
01-80358A86 (30-36 MHz)
01-80358A87 (36-42 MHz)
01-80358A88 (42-50 MHz)
01-80358A89 (66-88 MHz)
01-80358A90 (136-174 MHz)
01-80358A91 (406-512 MHz) Heavy Duty Spring
01-80358A92 (406-512 MHz) Standard Duty
Rubber gasket, 32-80369B53

ANTENNA MOUNT INSTALLATION INSTRUCTIONS

ROOF (PERMANENT 3/4" HOLE) MOUNT INSTRUCTIONS

TOOLS NEEDED:

- Safety glasses
- Hole saw, Motorola part # RPX-4387A
- 15/16" open - end wrench
- Solder,60/40 rosin flux
- Crimp tool, Motorola part # 66-80388A26 (Mini- UHF connector only)
- Electric drill
- Spanner wrench, Motorola part # 66-80371A75
- Soldering iron, 40-75 watts

1. Drill a 3/4" hole in vehicle with antenna hole cutting saw, Motorola part # RPX-4387A, and remove all burrs.

   Antenna hole saw will remove paint in a narrow ring around hole to assure good metal contact between vehicle and mount.

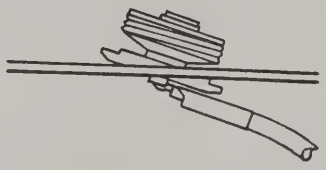


FIG.2

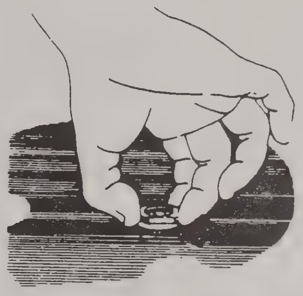


FIG. 3

2. Apply generous amounts of silicon grease to inner and outer threads of brass lock nut. Feed coax cable and mount through hole as shown in Figure 2.
3. Thread locking nut onto mount and pull up mount base to properly align in hole. While pulling up, finger tighten the locking nut against roof top, as shown in Figure 3.
4. Insert spanner wrench, part # 66-80371A75 or the tips of a needle nose pliers in bushing assembly to prevent mount assembly from slipping. Use a 15/16" open-end wrench to tighten locking nut firmly against vehicle surface. The locking nut must be in contact with vehicle metal to ensure proper antenna radiation. See Figure 4.

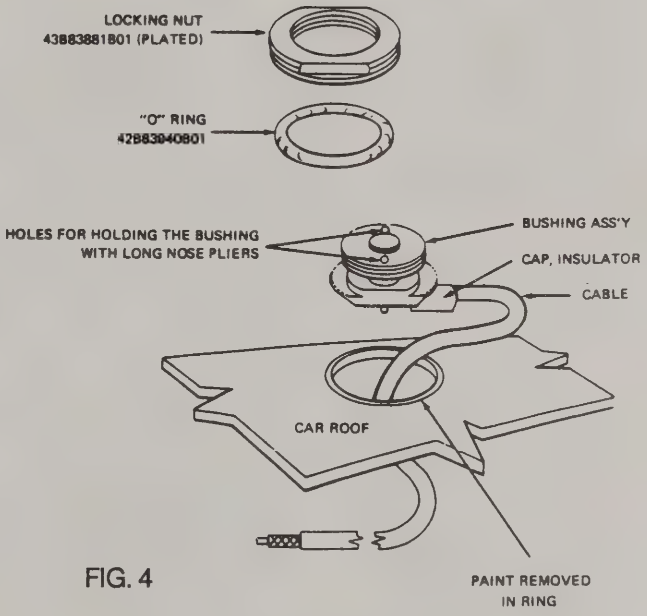


FIG. 4

TRUNK LID MOUNT INSTALLATION

1. Trunk lid mount may be placed at the center of trunk lid near rear window, or to the side, preventing the antenna from hitting rear window when raising trunk lid. Be sure the coaxial cable is not pinched under the mount clamp bracket. Figure 5.
2. Using the allen wrench supplied, tighten the set screws clockwise until the set screws break through the paint, creating a good contact.
3. Route coaxial cable from the trunk lid to the radio.

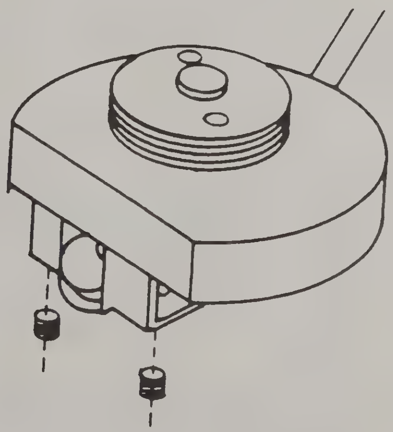


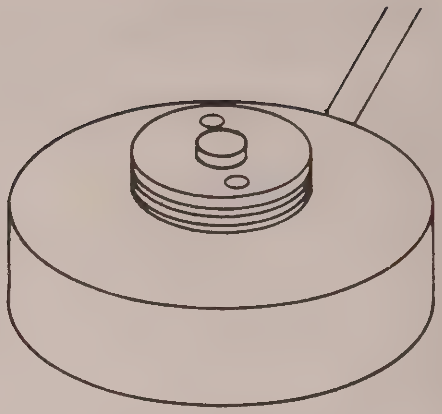
FIG. 5

MAGNET MOUNT INSTALLATION

WARNING

Do not use magnet mount on vinyl roofs, magnet mount will not properly hold antenna on vehicle, because holding power is reduced. Magnet mount will not "hold-on" to aluminum and non-metallic surfaces.

1. Remove all dirt and grime that will prevent magnet mount from seating securely.
2. Place magnet mount in final position. Sliding the mount may scratch paint surface.
3. Route coaxial cable to the radio. Figure 6.



Magnetic Mounted Base

FIG. 6

CONNECTOR INSTALLATION

Before installing the connector, cut off any excess length of cable (at the radio end) to avoid unnecessary signal loss. When the necessary preparations have been made, install the connector using the following steps.

UHF CONNECTOR - Motorola Part # 28-82021G01

Step 1. Disassemble the connector as shown in Fig. 7A.

Step 2. Cut off end of cable squarely and remove 3/4" of vinyl jacket. Fig. 7B.

Step 3. Slide coupling ring and adaptor on cable. Fig. 7C.

Step 4. Fan braid slightly and fold back as shown in Fig. 7D.

Step 5. Position adaptor to dimension shown in Fig. 7E. Press braid back over body of adaptor and trim to 3/8". Bare 5/8" of conductor. Tin exposed center conductor. Add teflon washer for 470 MHz and higher.

CAUTION

Use a hot soldering iron. DO NOT USE EXCESSIVE HEAT OR SOLDER. Solder quickly to avoid melting surrounding insulation.

Step 6. Screw adaptor to body of plug assembly. Solder braid to body of plug assembly through holes. Solder center conductor of cable to plug contact of plug assembly. Fig. 7F.

Step 7. For final assembly, screw coupling ring on plug assembly.

Step 8. Connect cable to antenna connector on radio set. Tighten coupling ring. Cross section of final assembly is shown in Fig. 7G.

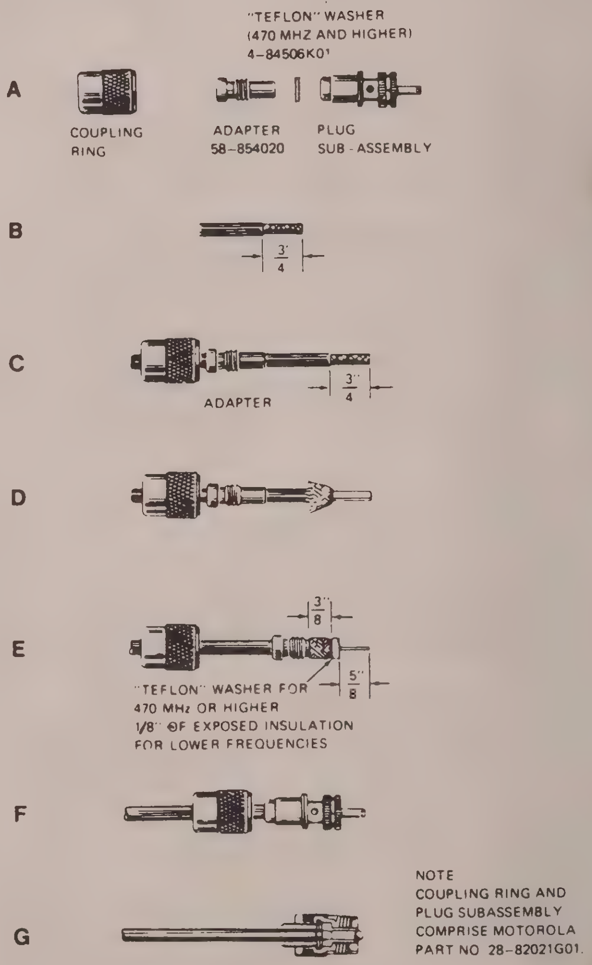


FIG. 7

MINI-UHF CONNECTOR # 28-84606M01
INSTALLATION INSTRUCTIONS

Use Motorola hand tool part # 66-80388A26 (Figure 8)
A deluxe rachet type tool is available, order part # 01-80320B17.

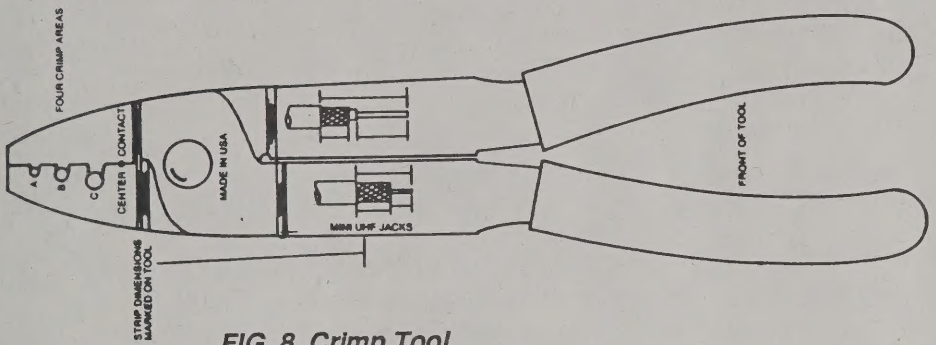


FIG. 8 Crimp Tool

Step 1. Slip ferrule and collar onto cable. See figure 9.

Step 2. Prepare cable to strip dimensions per figure 10 which is also marked on hand tool.

Step 3. Insert stripped cable into plug body until conductor is exposed (front end) and dielectric bottoms inside body. See figure 9.

Step 4. Crimp center contact using proper crimp section of tool. See figure 8 marked " CENTER CONTACT."

Step 5. Push collar forward onto plug assembly. Fit cable braid over support sleeve of connector. See figure 9.

Step 6. Push ferrule over braid until flange butts against connector body. Refer to figure 9. Using correct crimp area of tool, crimp ferrule close to plug body. See figure 8 crimp location "C". Crimp ferrule a second time close to cable end.

Step 7. Protruding center conductor should be trimmed flush with end of center contact.

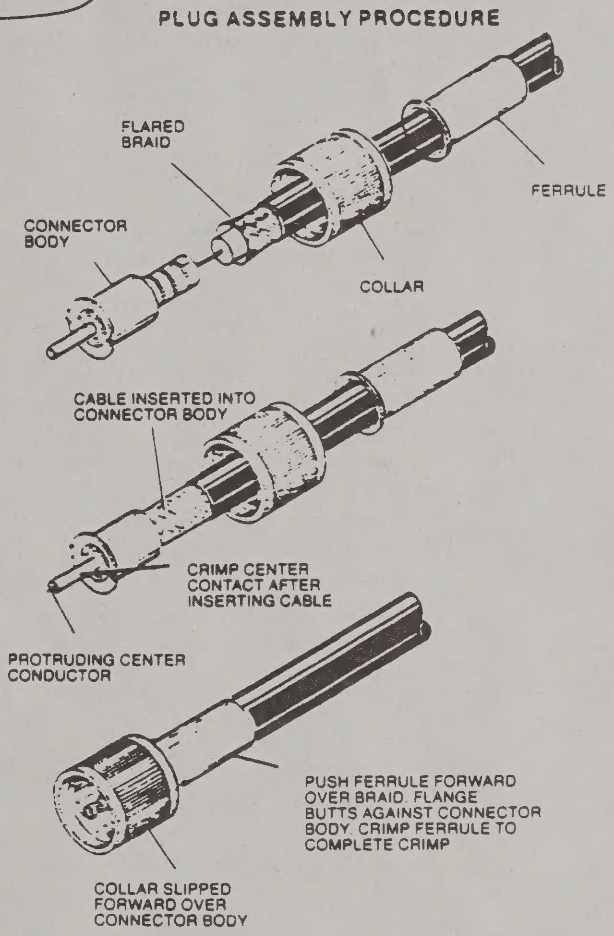

PLUG ASSEMBLY PROCEDURE
FLARED BRAID
FERRULE
CONNECTOR BODY
COLLAR
CABLE INSERTED INTO CONNECTOR BODY
CRIMP CENTER CONTACT AFTER INSERTING CABLE
PROTRUDING CENTER CONDUCTOR
PUSH FERRULE FORWARD OVER BRAID. FLANGE BUTTS AGAINST CONNECTOR BODY. CRIMP FERRULE TO COMPLETE CRIMP
COLLAR SLIPPED FORWARD OVER CONNECTOR BODY

FIG. 9

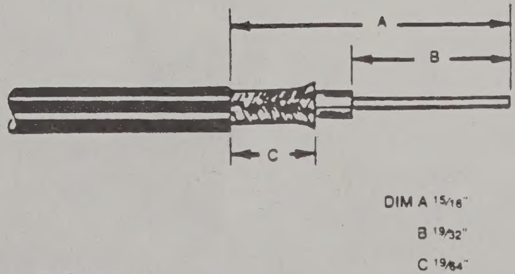


FIG. 10

TUNING THE ANTENNA

WARNING

Adjusting the whip length while radio is keyed, may cause burns from RF radiation.

NOTE:

* Tune antenna in an open area at least 12 feet from any metal objects.

* *Lengths shown on the cutting chart are approximate.* Due to antenna variations and mounting location effects, *we recommend cutting the antenna rod 1-1/2" longer than the chart* and then cutting 1/2" off at a time until reflected power is minimized.

* DUE TO ANTENNA INTERACTION WITH VEHICLE, SOME LOW BAND ANTENNA MOUNTING LOCATIONS WILL NEVER ACHIEVE 1.5:1 VSWR. In this case, trim the whip for minimum reflected power. A simple table for converting the ratio of forward power and reflected power to VSWR is shown below in TABLE 1.

1. Locate the transmitter frequency on the cutting chart. In the case of multiple transmitter frequencies, calculate the mid-frequency and locate on cutting chart. Read desired whip length from the chart. *Cut the whip 1-1/2" longer than this length.*

   Trim the antenna rod (Low and High band) from the bottom only. On the UHF antenna whip, trim the whip from the bottom of the rod below the phasing coil.

2. Use the set screw to secure the antenna whip in the whip adaptor assembly.

3. Using an in-line wattmeter, measure forward and reflected power at the desired transmit frequency and calculate VSWR using Table 1.

4. If VSWR is >1.5:1, then trim off 1/2"and repeat step 3.

5. Repeat steps 3 and 4 until minimum VSWR is obtained.

6. Use the adjustment range of the whip in the adaptor in order to minimize VSWR.

7. Insert the shorter part of the allen wrench into screw and tighten set screw as tight as you can by hand. If a torque wrench is available, tighten set screw to a torque of 25-30 inch-lbs.

TABLE 1

A simple table for converting the ratio of forward power and reflected power to VSWR is given below:

Pfwd / Pref	VSWR
440.6	1.1 : 1
58.8	1.3 : 1
25.0	1.5 : 1
14.9	1.7 : 1
10.4	1.9 : 1
7.9	2.1 : 1

EXAMPLE: If the forward power (Pfwd) is measured as 100 watts and the reflected power (Pref) is 3 watts, calculate Pfwd / Pref = 33.3. Since 33.3 is between 25 and 58.8, the chart above indicates that the VSWR is less than 1.5 : 1.